

INDIA

# RUBBER WORLD

AUGUST, 1943

Outstanding tear and abrasion resistance

## SPHERON 6

MPC\* CARBON BLACK FOR  
RUBBER COMPOUNDING



GODFREY L. CABOT, INC., Boston 10, Mass.



**Build top performance into your  
products with**

# **NEOPRENE LATEX**

In many products, neoprene latex has established new performance standards. Because only with neoprene latex can you get *all* these advantages:

- **Toughness and durability**
- **Sunlight resistance**
- **Excellent aging**
- **Flame resistance**
- **Oil resistance**
- **Low permeability to gases**

Individual types of latices are available to fit your specific product and plant requirements. In your plant you will find that the neoprene latices are:

- **Stable in storage**
- **Stable during compounding**
- **Stable during processing**
- **Adaptable to normal manufacturing methods**
- **Free from precure**

**REPORT 48-1** contains more information on the currently available neoprene latices. Extra copies are available. Write: E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division, Wilmington 98, Delaware.

**DU PONT RUBBER CHEMICALS**  
E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.

**DU PONT**

BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

TECHNOLOGY DEPARTMENT

# TWO NEW HYCAR AMERICAN RUBBERS

## Hycar OR-25 EP (*Easy Processing*) Hycar OR-25 NS (*Non-Staining*)



HERE are two new American rubbers, both with superior processing characteristics. Hycar NS and Hycar EP differ only in that a special anti-oxidant has been used in the NS, making it non-staining and non-discoloring. This is an outstanding quality, particularly desirable in the fabrication of light colored products. The new Hycar rubbers have all these advantages over the regular process Hycar OR-25:

1. They band on the processing mill speedily—cut mill mixing time.
2. Better extrusion characteristics—less nerve and less heat build-up.
3. Excellent high temperature mixing.
4. Better fusion and mold flow characteristics.
5. Increased building tack for laminated products, such as frictioned stocks and calendered sheeting.

Both rubbers retain those properties which make Hycar American rubbers so usable for so many products . . . permanent resiliency and superior resistance to oil, abrasion, and aging. Ask your supplier for parts made from Hycar. Or write to Dept. HA-8, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

**Hycar**  
Reg. U. S. Pat. Off.  
*American Rubber*

**B. F. Goodrich Chemical Company**

A DIVISION OF  
THE B. F. GOODRICH COMPANY

GEON polyvinyl materials • HYCAR American rubber • KRISTON thermosetting resins • GOOD-RITE chemicals

# Fast Cure...

## WITH PHILBLACK A!



**You don't believe in miracles?** Then you should see Philblack A in action! Fast cure with less acceleration is only one of the near-miracles that this HMF type black can perform for you. It will speed up processing time materially (usually 10 to 25%) and help greatly in obtaining smooth extrusions.

**And what good finished products you get** when this wonder-working black goes to work for you. Resilience?...Good! Pliancy?...Wonderful! Abrasion resistance?...Excellent! In addition, you benefit from low hysteresis when you use this HMF type black. Try Philblack A, today.

**PHILLIPS PETROLEUM COMPANY**

*Rubber Chemicals Division*

EVANS SAVINGS AND LOAN BUILDING • AKRON 8, OHIO



INDIA RUBBER WORLD

# "NOMINATED ON THE FIRST BALLOT!"

The majority of rubber compounders specify  
**Naugatuck Antioxidants**

## AMINOX

The standard antioxidant for tubes — tire carcass belt frictions—compounded latex. Maximum protection against heat and oxygen.

B-L-E-25

The standard antioxidant for tires — treads and carcass. This new type of low viscosity permits easy handling and complete dispersion.

FLEXAMINE

The standard antioxidant for controlling flex-cracking combined with resistance to heat and oxygen and protection against copper contamination.

NAUGATUCK



CHEMICAL

Division of United States Rubber Company

1230 AVENUE OF THE AMERICAS • NEW YORK 20, N.Y.

IN CANADA: Naugatuck Chemicals Division, Dominion Rubber Co., Elmira, Ont.

PROCESS  
ACCELERATE  
PROTECT with  
**NAUGATUCK  
CHEMICALS**

# Increase your **PROFITS**



...in the rubber industry...  
get these **THERMALL**  
**Profit Builders!!**

- Increase Banbury output, save labor and power costs.
- Shorten breakdown time on mills, save labor and power costs.
- Improve compounding quality.
- Improve molding quality and reduce curing defects.
- Increase capacity of mixing on open mill by heating crude rubber and reclaimed rubber.
- Cut curing time up to 50% and more.
- Increase equipment life, reduce maintenance costs.
- Break down **Hard Stocks** easier, faster, save labor and power costs.

**Thermall** equipment is extremely economical to operate.

**Thermall** Electronic Heating equipment generates heat right where it is wanted, "*in the material itself*".

**Thermall** equipment will speed up checking materials in laboratory, such as mixed stock, checking for proper dispersion of pigments in rubber . . . checking of cord fabrics for moisture content . . . and all other types of materials.

SEE **THERMALL DEMONSTRATED**  
IN YOUR OWN PLANT  
WITHOUT OBLIGATION



## ELECTRONIC RUBBER HEATING

For full information on the advantages and uses and for demonstration, write . . .

**W. T. LA ROSE & ASSOCIATES, INC.**  
**TROY, NEW YORK, U. S. A.**

GUARANTEED PERFORMANCE . . . or it doesn't cost you a cent!

# Good-rite VULTROL

for use in American rubber compounding  
to prevent scorching, and for recovering  
scorched stocks

GOOD-RITE AND VULTROL REG T M U S PAT OFF

For technical data please write Dept. CA-8

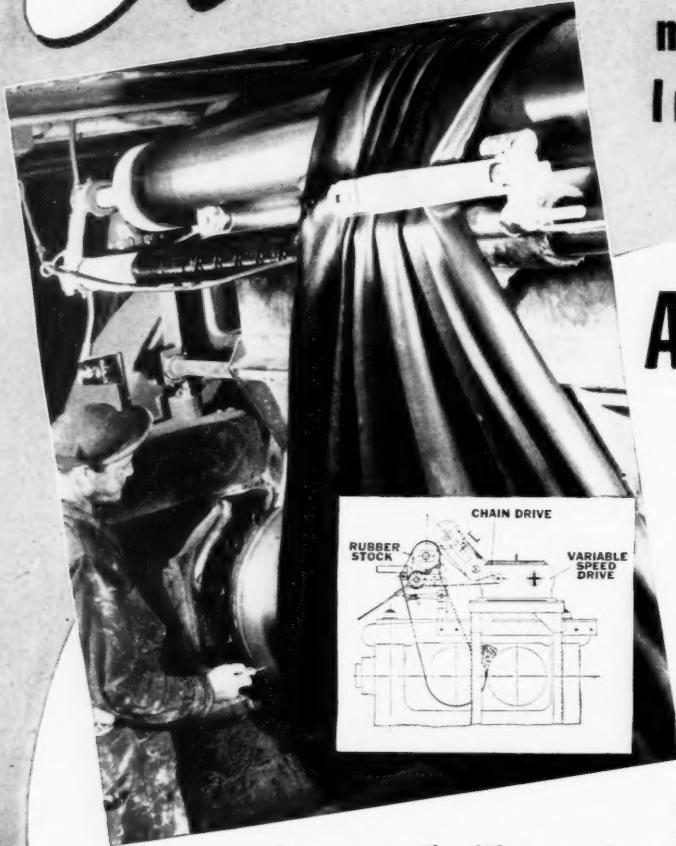
**B. F. Goodrich Chemical Company**

ROSE BUILDING, CLEVELAND 15, OHIO

A DIVISION OF  
THE B. F. GOODRICH COMPANY

GEON polyvinyl materials • HYCAR American rubber • KRISTON thermosetting resins • GOOD-RITE chemicals

# 6 BIG ADVANTAGES...



make this attachment  
Indispensable!

## .. the Akron-Standard STOCK BLENDER

Tire manufacturers testify, "Once used, never without." Handling labor is reduced. Operation is automatic until the milled stock is removed. Speed up your operation and enjoy more uniform stock production through these six features:

1. Manpower goes further. One workman can run two or more mills. No more laborious hand blending and warm-up.

2. Temperature reduced by passing compound or batch overhead. Cooler stocks permit adding accelerators without scorching.
3. Positive bank control with lower power consumption.
4. Correct milling time for every batch.
5. Less mixing time (or larger batches proportionately).
6. Uniform operation, uniform plasticity, uniform dispersion.

*Ask for our 40-page Bulletin "W-8" describing this and many other profit-earning types of Akron-Standard equipment.*

## The Akron Standard Mold Co.

1624 Englewood Avenue Akron 5, Ohio, U. S. A.

*"The  
Established Measure  
of Value"*



**STABILITY** . . . Marvinol VR-10 is superior in resistance to heat, light and other normally destructive factors.



**VERSATILITY** . . . Marvinol VR-10 is easy to process . . . may be calendered, extruded, injection molded, used in non-aqueous dispersions, formulated as unplasticized rigids . . . uniquely versatile.



**TOUGHNESS** . . . Marvinol's high molecular weight offers you extra toughness and "dryness" with long life . . . resists tear, wear, oils, acids.

## MARVINOL®—vinyl resin for modern high-speed equipment offers you all these advantages



### WIDER TEMPERATURE RANGE

. . . Marvinol VR-10 assures you products that show less deformation due to heat . . . gives greater low temperature flexibility.



**EASILY CLEANED** . . . Marvinol-based products are easily and quickly cleaned because of their smooth surface. They're waterproofed, unaffected by mold or fungi.



The New Ultra-Modern Marvinol Plant contains the latest equipment to assure efficient operation, uniform production of the highest quality. Send today for details. Write on your company letterhead to Chemicals Division, Dept. I-8, The Glenn L. Martin Company, Baltimore 3, Maryland.



**COLOR** . . . Marvinol offers many opportunities for distinctive coloring . . . from clear to delicate or brilliant shades.



**CLOSE COOPERATION** . . . The Glenn L. Martin Co. compounds and fabricates only in its customer service laboratory for your benefit. We sell only raw materials. Our sales engineers and modern customer research laboratory are ready to help with your processing problems.

*Martin*

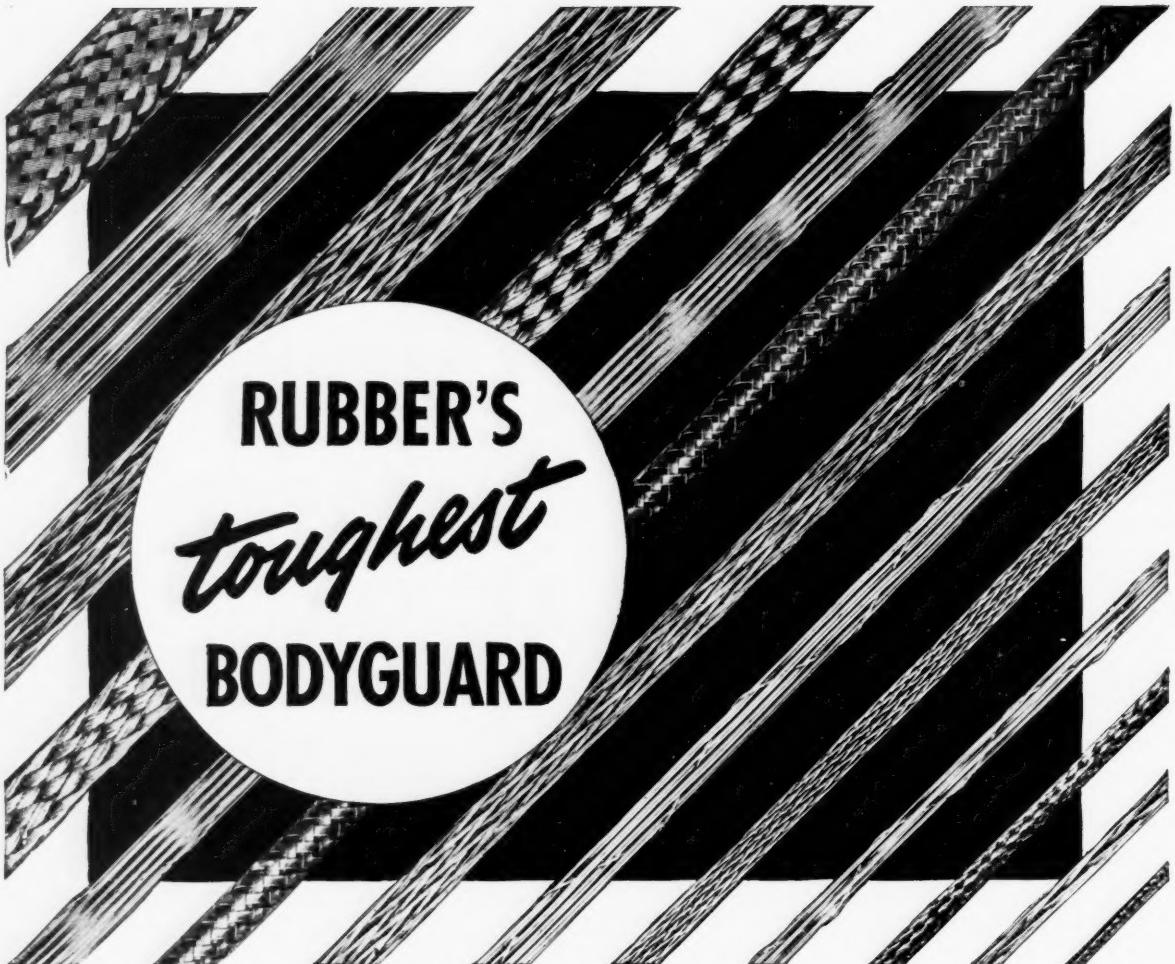


*Marvinol*

RESINS, PLASTICIZERS AND STABILIZERS PRODUCED BY THE CHEMICALS DIVISION OF

THE GLENN L. MARTIN COMPANY • AN INTERNATIONAL INSTITUTION

"BETTER PRODUCTS, GREATER PROGRESS, ARE MADE BY MARTIN"



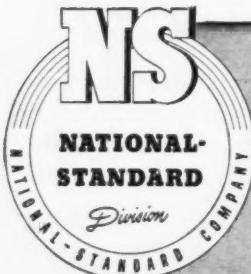
ALMOST 40 years ago we started a job here at National-Standard that's grown bigger and bigger with each passing year. That job is the application of fine wire to rubber—to support rubber and greatly extend its usefulness... to give rubber products unprecedented strength and life.

Today you have only to look at the amazing work records of wire-reinforced products to realize that wire has become rubber's toughest, most capable bodyguard—in tires, V-belts, flat belts, conveyor belts, tubes, conduit, hose, and scores of other products.

The tubular and flat braids, tapes and metallic strands shown above are just a few of the fine

wire structures specially engineered by National-Standard for these and many more wire-and-rubber applications—painstakingly developed and precision-produced to help make new and improved products practical and profitable for manufacturer and user alike.

As always, we at National-Standard welcome the opportunity to work with you in the planning of your products. Perhaps you too stand to gain with a specially developed wire or fabrication. Possibly we can also contribute in the development of cost-saving machinery for the application of your wire. In any case, our specialized engineering service is at *your* service, now, or at any time.



#### DIVISIONS OF NATIONAL-STANDARD COMPANY

##### NATIONAL-STANDARD

Niles, Mich.

Tire Wire, Fabricated Braids and Tape

##### ATHENIA STEEL

Clinton, N. J.

Flat, High Carbon, Cold Rolled Spring Steel

##### WORCESTER WIRE WORKS

Worcester, Mass.

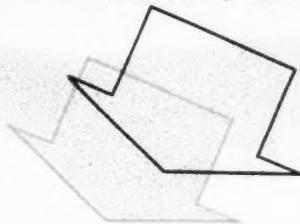
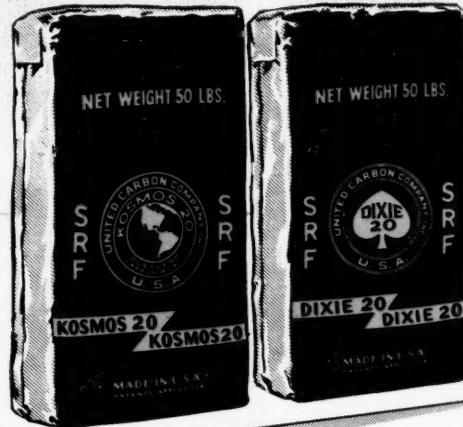
Round Steel Wire, Small Sizes

##### WAGNER LITHO MACHINERY

Jersey City, N. J.

Lithographing and Special Machinery

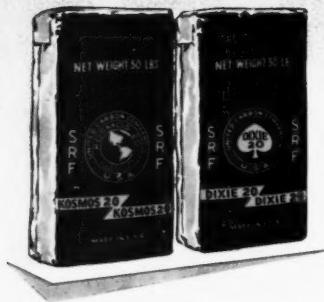
# United Blacks



Plainly and distinctively colored designations make United bags for each type of carbon black easy to identify . . . another advantage in using United Blacks.

**UNITED CARBON COMPANY, INC.**

NEW YORK • AKRON • CHARLESTON 27, W. VA. • CHICAGO • BOSTON



KOSMOS 20—DIXIE 20, an SRF type carbon black, possesses perfect balancing of all component properties essential to satisfactory rubber performance; outstanding for ease of processing, good plasticity, fast rate of cure, high resiliency, and low heat build-up.



DIXIE 40—KOSMOS 40, an HMF type carbon black with these properties—cool mixing, smooth and rapid extrusion, fast rate of cure, high resistance to cut-growth, flex cracking and abrasion. Produced by a special process this furnace type black is especially useful for tires, tubes, footwear, and mechanical goods.



KOSMOS 50—DIXIE 50, an HMF type black, made by a new United process, in specially designed furnaces from carefully selected fuel. Featured by ease of mixing, ready dispersion, fast extrusion, low shrinkage and fine appearance of stock, also a quick curing black, yielding high modulus and tensile.



DIXIE 60—KOSMOS 60, an RF type black, new, different, and better. A fast curing black requiring low acceleration, it has been acclaimed for faster and smoother processing, high extrusion efficiency, less rejects at tuber, low shrinkage, glossy smoothness, dense appearance, freedom from ragged edges and for outstanding reinforcement for resistance to tread wear.

RESEARCH DIVISION

**UNITED CARBON COMPANY, INC.**

Charleston 27, West Virginia

**FOR  
MOLDED  
ITEMS IN COLOR  
SPECIFY**



# **PLIOLITE S-6**

THESE bright-colored molded rubber products have the toughness and hardness of the best reinforced rubber stocks—yet they contain no carbon black.

That's because they have been stiffened by **Pliolite S-6**, Goodyear's incomparable reinforcing agent. The result is, these items are durable enough to withstand all kinds of abuse.

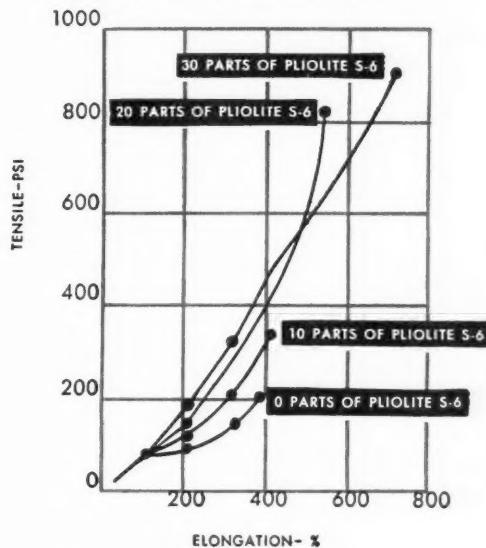
**Pliolite S-6** is well adapted to all compounds needing a light-color, low-gravity stock of 70-100 durometer hardness with good processing characteristics and moldability. Its reinforcement is positive—coupling extra hardness with negligible loss in elongation. Often elongation is improved. It increases flex-life, tear-and-abrasion-resistance. It is the outstanding, colorless, reinforcing material.

**Pliolite S-6** is effective with GR-S, Neoprene, Buna N and natural rubber. It is available as a powder for your own mixing, or in master batches in whatever rubber you select. For complete information and sample, write: Goodyear, Chemicals Division, Akron 16, Ohio.

Note—Molded articles courtesy  
The Wooster Rubber Company



Stress-strain curve for unfilled GR-S reinforced with **PLIOLITE S-6** shows the added length and strength contributed by this superb reinforcing agent



**GOOD** **YEAR**





# The Governor of California invites You



EARL WARREN  
GOVERNOR

State of California  
GOVERNOR'S OFFICE  
SACRAMENTO

To American Industry:

In California we are currently celebrating the centennial anniversaries of the beginnings of our State. We gain much inspiration from our review of the progress which has been made in the comparatively short span of one hundred years.

During the past eight and one-half years alone California's population has increased by 47 per cent and our industry and agriculture have risen to positions of great importance in the economic life of the nation.

Our tremendous reserves of natural resources and our strategic world trade position on the shores of the Pacific Basin assure California's continued progress in the years to come.

I am happy, therefore, to join in inviting you to investigate the opportunities for expansion which exist in the many communities of our State.

Sincerely,

A handwritten signature of Earl Warren, followed by the title "Governor".



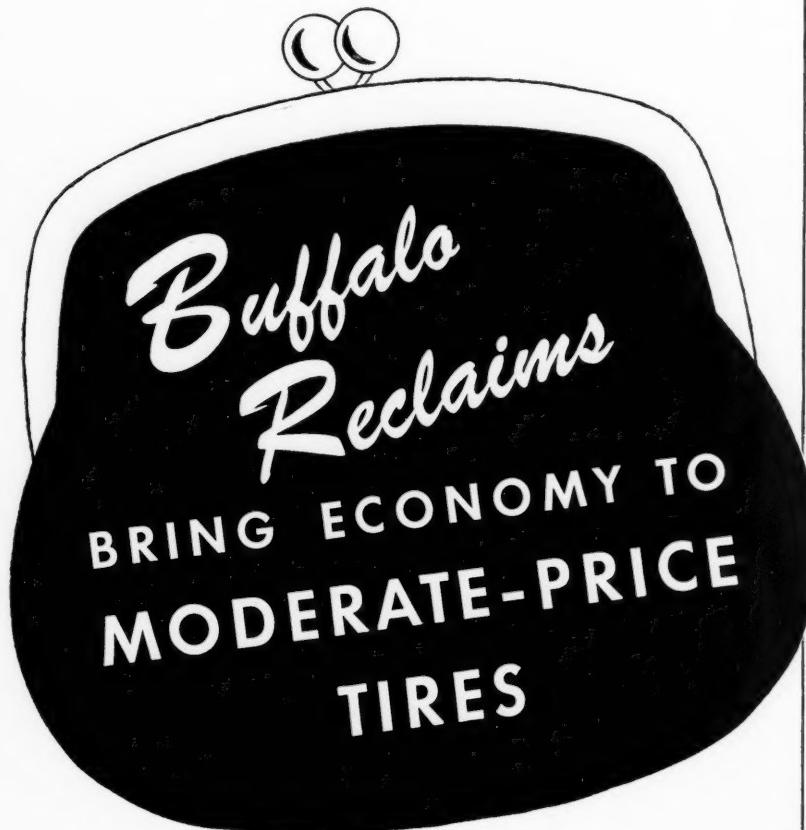
Earl Warren

\* One of a series of advertisements based on industrial opportunities in the states served by Union Pacific Railroad.

Unite with Union Pacific in selecting sites and seeking new markets in California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, Oregon, Utah, Washington, Wyoming.

\*Address Industrial Department, Union Pacific Railroad  
Omaha 2, Nebraska

**UNION PACIFIC RAILROAD**  
*Road of the Daily Streamliners*



You'll cut costs with these Buffalo reclaims. Compounds of crude and reclaim will process faster than all crude. Hence Buffalo reclaims are logical replacements for new rubber, and cost considerably less. Write for further details on the numbers that interest you.

**U. S. RUBBER RECLAIMING COMPANY, INC.**  
500 FIFTH AVENUE • NEW YORK 18, N. Y. • (Plant at Buffalo, N. Y.)

TRENTON . . . H. M. ROYAL, Inc., 689 Pennington Avenue

66 Years Serving the Industry Solely as Reclaimers

## BUFFALO

### CARCASS RECLAIMS

These mill quickly, calendar freely and provide compounds with satisfactory tackiness for building. Tire carcasses made with these Buffalo reclaims have good adhesion. Heat build-up is reduced.

**2017:** a whole tire blend of natural and synthetic rubber.

**U.S.-140:** a GR-S whole tire reclaim of superior quality.

**TIOGA:** black carcass reclaim—high rubber content.

## BUFFALO TREAD and

### SIDEWALL RECLAIMS

These process well, giving good resistance to abrasion, cutting and flex cracking.

**5213; 5211:** Standard peel-type reclaims.

**R-575:** especially plastic—has excellent tack.

### FOR THE CARCASS OF WHITE SIDEWALL TIRES

**3013:** ideal for use under white sidewalls because of its non-staining and non-bleeding properties.

# MEMORANDUM

To

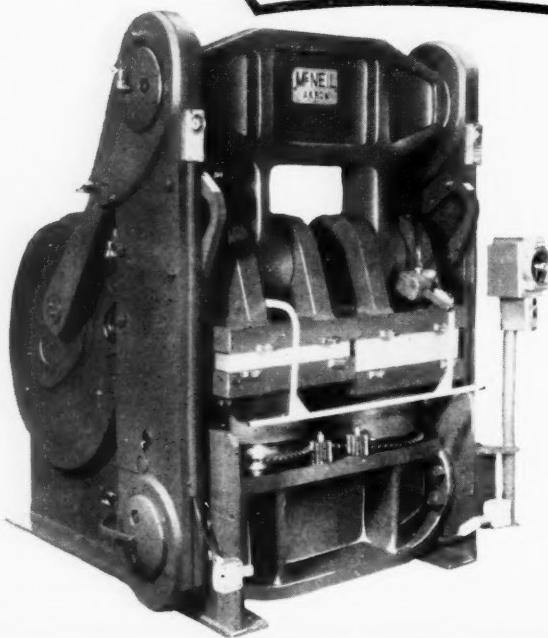
Chief Engineer  
Factory Manager  
Production Manager

Would you be interested in higher quality of goods produced Plus production per mold increases up to 50% with proportionate reduction in cure cost per piece?

as m

# MCNEIL AKRON

## MECHANICAL GOODS PRESS MODEL 800-24x24 TWIN



- MOTOR OPERATED — NO HYDRAULIC
- 800,000 POUNDS TOTAL PRESSURE
- TWO PAIR 24 x 24 DRILLED PLATENS INDIVIDUALLY ADJUSTABLE
- 700 POUNDS PER SQUARE INCH PLATEN PRESSURE
- SIMPLE SPEEDY ADJUSTMENTS OF LOWER PLATENS
- ADJUSTMENTS FOR MOLD LOADINGS ZERO TO 200 TONS EACH MOLD POSITION
- TWO 24 x 24 MOLDS MAY BE USED IN SAME OR DIFFERENT THICKNESSES OR ONE 24 x 48 MOLD—1" MINIMUM, 6" MAXIMUM

SALES AGENT, Eastern States, B. H. DAVIS, 928 Glenview Rd., Ridgewood, N. J.  
MANUFACTURING AGENTS, GREAT BRITAIN—Francis Shaw & Co. Ltd., Manchester, England  
AUSTRALIA and NEW-ZEALAND—Chas. Ruwolt Proprietary, Ltd., Victoria, Australia.

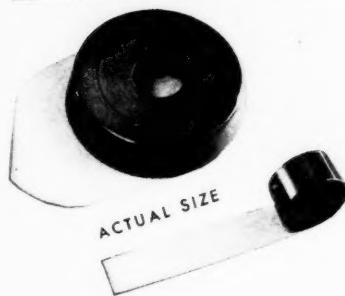
# THE MCNEIL MACHINE & ENGINEERING CO.

96 East Crosier St.

Akron 11, Ohio

RUBBER WORKING MACHINERY • INDIVIDUAL CURING EQUIPMENT FOR TIRES, TUBES and MECHANICAL GOODS

# ALL-ROUND improvement for Hard and Semi-Hard Stocks

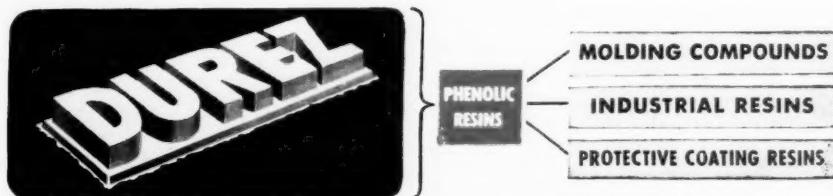


... with **DUREZ** Resins

▲ If you could find one ingredient that would have the following effects in your compounds, would you use it?

- Improve mixing . . . by plasticizing and reducing nerve.
- Carry extra loading . . . by its fluidity when hot.
- Improve molding . . . by becoming plastic and then hardening.
- Reduce vulcanizing time . . . by its fast cure and vulcanizing effect.
- Increase hardness . . . by setting hard in itself.
- Increase stiffness . . . by its natural cured rigidity.
- Reinforce . . . by increasing tensile strength.
- Improve wear . . . by improving abrasion resistance.
- Resist higher temperatures . . . by its natural heat resistance.
- Improve chemical resistance . . . by its inherent solvent and chemical resistance.
- Produce glossy finish . . . by its natural high gloss.
- Improve weather resistance . . . by its resistance to water and oxidation.

● All these benefits at a minimum sacrifice of elongation and flexibility. This ingredient, with so many unbelievable advantages, is Durez 12687 Resin for Buna N Rubber and Durez 13355 Resin for GRS Rubber. Samples available to rubber manufacturers. Write for folder "Durez Resins in the Rubber Industry." Durez Plastics & Chemicals, Inc., 309 Walck Rd., N. Tonawanda, N.Y.



PHENOLIC RESINS THAT FIT THE JOB

# Have You Tried PROTOX-166 in Your Processing

**P**ROTOX-166 is the Zinc Oxide that has the successful combination of properties for providing improved processing of both synthetic and natural rubber at lower cost. The increase in apparent density of this pigment permits mixing of larger master batches on the Banbury Mixer and on the roll mill.

Because it is treated with propionic acid,\* *Protox-166* mixes more rapidly and more easily and the quality of the dispersion obtained is very much better. These mixing qualities mean lower mixing costs and measurably less power consumption.

Being slow-curing, *Protox-166* permits more latitude in accelerator concentration, and provides for cooler running stocks on the calender and in the tuber. Besides, calender shrinkage, extrudability and Mooney plasticity data demonstrate the more desirable properties of *Protox-166* over other Zinc Oxides.

If you have not tried *Protox-166* in your processing, let us know and we'll gladly send additional data and a sample for trial.

## TO GET ALL These Advantages

1. Bulks about two-thirds of the volume of **XX-4**
2. Improves processing (incorporates more rapidly with better dispersion)
3. Permits larger master batches
4. "Slow-Curing" (practically the same rate as **XX-4**, with an indication of a greater lag in early cures; inhibits scorching)
5. Has lowest moisture pick-up of all brands of Zinc Oxide
6. Gives good modulus, tensile, tear resistance, and heat build-up properties
7. Lowers power consumption and mixing costs



\*U.S. Patents 2,303,329  
and 2,303,330

## THE NEW JERSEY ZINC COMPANY

160 FRONT STREET • NEW YORK 7, N. Y.

Products Distributed by THE NEW JERSEY ZINC SALES COMPANY

NEW YORK • CHICAGO • BOSTON • CLEVELAND • SAN FRANCISCO • LOS ANGELES

Will this  
fit into  
your  
process?



**INDONEX**  
REG. U.S. PAT. OFF.  
*plasticizers*

for lower  
costs



✓ Check the circulars  
you want and clip the list to  
your letterhead. Mail to:

General results obtainable with INDONEX in natural and synthetic rubbers have been described in our Bulletin No. 13, while various other specific applications of INDONEX are discussed in the following Circulars:

- 13-1—Butyl Rubber Compounds     13-2—Butadiene-Acrylonitrile Copolymer Compounds
- 13-3—Neoprene Compounds     13-4—Tire Carcass Compounds     13-5—Footwear and Heel Compounds     13-6—Camel Back     13-7—Motor Mount and Bumper Compounds
- 13-8—Wire Jacket and other Extruded Compounds     13-9—GR-S Packing Compounds
- 13-10—Hose Compounds     13-11—Hard Rubber Compounds     13-12—Low Hardness Mechanical Goods     13-13—Neoprene Mechanical Goods     13-14—Hycar OR-15
- 13-15—Natural Rubber—Reclaim Mechanical Goods and Carcass Compounds     13-16—Hard Rubber Compounds     13-18—Masterbatch Addition to Natural Rubber Compounds     13-19—Various Fillers in Reclaim Stocks     13-20—Selection of INDONEX-Accelerator Combinations
- 13-21—Compounds for High Temperature Cures     13-22—Natural Rubber of Various Qualities.

**STANDARD OIL COMPANY (INDIANA)**  
Chemical Products Department

910 South Michigan Avenue

Chicago 80, Illinois

August, 1948





...increases bond strength  
of latex adhesives

**Also** increases modulus and  
wear resistance of  
latex films and coatings

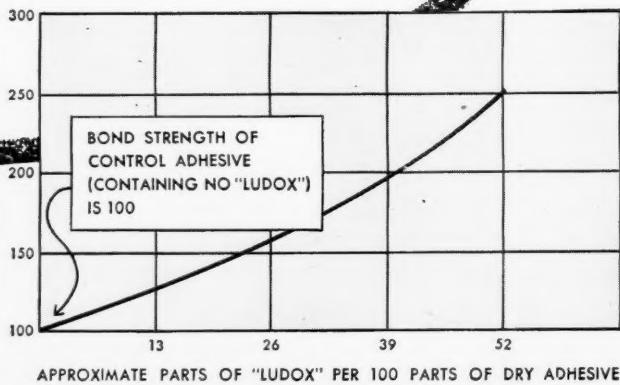


CHART SHOWS STRENGTH increase obtained in leather to leather adhesion using a commercial, natural rubber latex adhesive, containing "Ludox."

NEW DU PONT "LUDOX" now offers a means of increasing the bonding strength and versatility of your latex adhesives.

"LUDOX" STRENGTHENS—as much as two to three times—latex adhesion to a wide variety of surfaces . . . including fabric to fabric, leather to leather, and latex to metal. And, in many instances, it gives superior bonds where there is no adhesion with silica-free latex compositions.

#### Improves Latex Films and Coatings

"LUDOX" improves wearing qualities by decreasing abrasion up to 50%. It also reduces water absorption and swelling of neoprene and it gives outstanding increases in the modulus of neoprene-dipped goods.

#### New 30% Concentration Now Available

"LUDOX" is now available as a 30% aqueous, colloidal

solution . . . highly fluid and substantially free of alkali.

"LUDOX" contains silica high in purity . . . chemically reactive and finely subdivided. The particle size is less than 1/1,000,000 of an inch.

#### Technical Assistance

For further information on how "Ludox" can help you make better latex products, write or wire Du Pont today. A Du Pont technical representative will be glad to discuss with you the application of this new development to your own products.



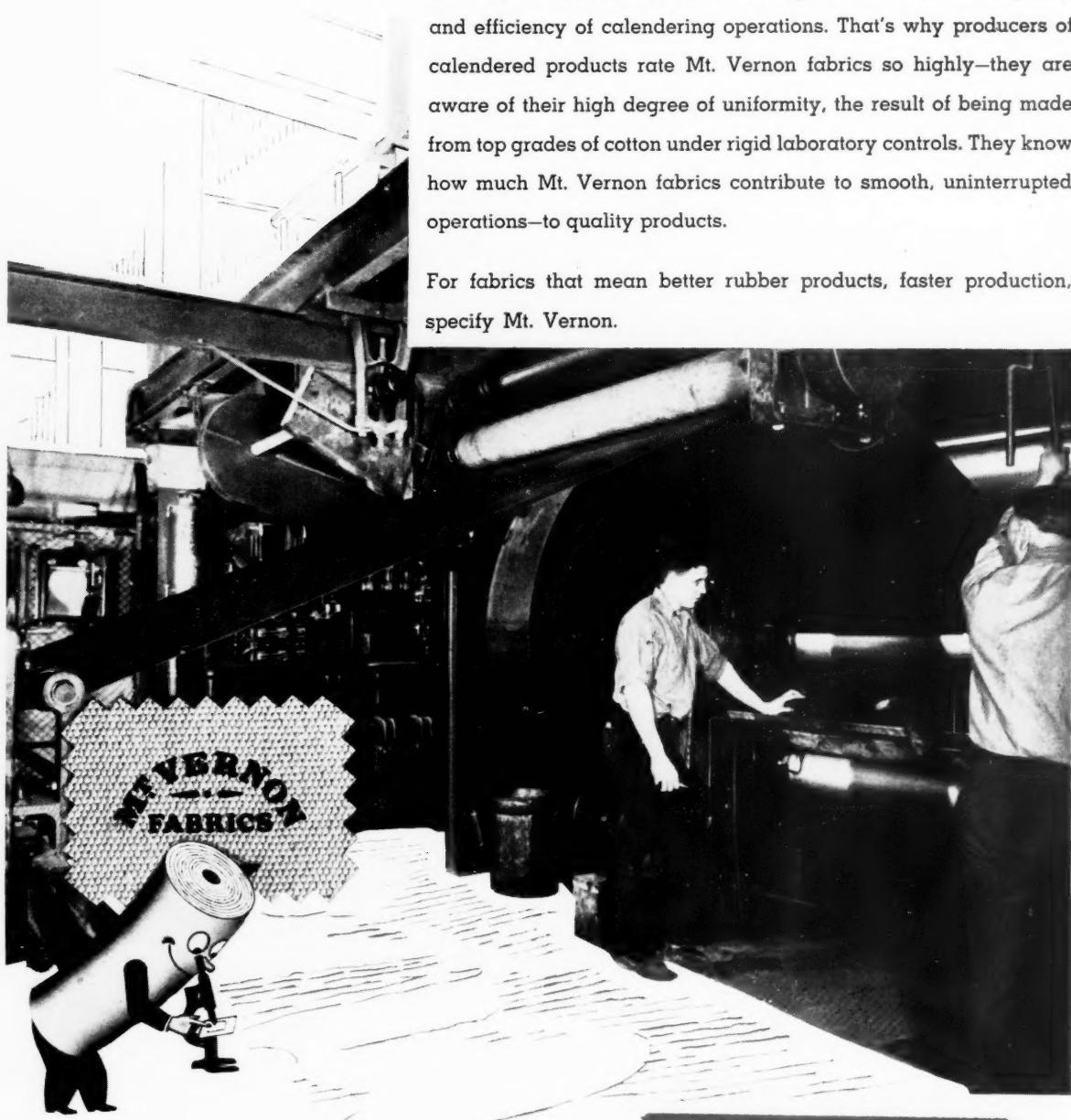
BETTER THINGS FOR BETTER LIVING  
... THROUGH CHEMISTRY

**E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Department, Wilmington 98, Delaware**

# *Production Really Rolls with Mt. Vernon Fabrics*

**C**onsistent fabric quality can make a great difference in the quality and efficiency of calendering operations. That's why producers of calendered products rate Mt. Vernon fabrics so highly—they are aware of their high degree of uniformity, the result of being made from top grades of cotton under rigid laboratory controls. They know how much Mt. Vernon fabrics contribute to smooth, uninterrupted operations—to quality products.

For fabrics that mean better rubber products, faster production, specify Mt. Vernon.



*Mt. Vernon-Woodberry Mills*

**TURNER HALSEY**

COMPANY  
Selling <sup>(In)</sup> Agents

40 WORTH ST. • NEW YORK

Branch Offices: CHICAGO • ATLANTA • BALTIMORE • BOSTON • LOS ANGELES • AKRON

# ULTRAFINE PRECIPITATED CALCIUM CARBONATES



Try improving quality of your rubber and plastics products by use of ultrafine, non-abrasive, precipitated calcium carbonates.

In **RUBBER** products of white or light colors, Multifex grades impart high tensile strength and resistance to tear (hot and cold). They yield low modulus, high elongation, good flexibility and low heat build-up properties. For comparative particle size materials, power requirements for mixing are exceptionally low. Best properties are developed at 60 to 100 parts loading to 100 parts natural or synthetic rubber.

In **PLASTICS**, Multifex grades can be used to increase hardness, improve scratch resistance and decrease whitening with minimum loss of tensile strength and elongation at break. Light stability of plastic compositions are improved with Multifex. Loadings of 10 parts to 50 parts per 100 parts of plastic-plasticizer give improved properties.

## THREE MULTIFEX GRADES

**1. MULTIFEX** is an uncoated, non-abrasive calcium carbonate, precipitated from water clear solutions, of about .03 to .04 microns particle size.

**2. SUPER MULTIFEX** is of the same particle size as **MULTIFEX** but which has been given a double coating (before and after drying) with an organic compound. The first coating retards agglomeration during drying. Both coatings aid dispersion in mixing processes.

**3. MULTIFEX MM** differs from the other grades in that the particle size is .05 to .06 microns. This grade is more easily dispersed due to this feature, requires slightly less power to incorporate, and in many instances provides quality equal to the finer grades due to a more complete dispersion.

NOTE: **MULTIFEX MM** can be supplied with a dry coating if customer's requirements demand.

## DIAMOND ALKALI COMPANY PURE CALCIUM PRODUCTS DIVISION P. O. BOX 407, PAINESVILLE, OHIO

### BRANCH OFFICES

BOSTON 2, MASS.  
80 Federal St.  
CHICAGO 6, ILL.  
20 North Wacker Dr.

CINCINNATI 2, OHIO  
308 Keith Bldg.  
CLEVELAND 13, OHIO  
633 Penton Bldg.  
DALLAS 2, TEXAS  
So. Lamar & Lenway Sts.

HOUSTON 2, TEXAS  
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- Eliminates slab sticking without the dust nuisance of talc, soapstone, whiting or clay. A non-adhesive coating is effected by either dipping, spraying or brushing. Fast drying speeds up operations.
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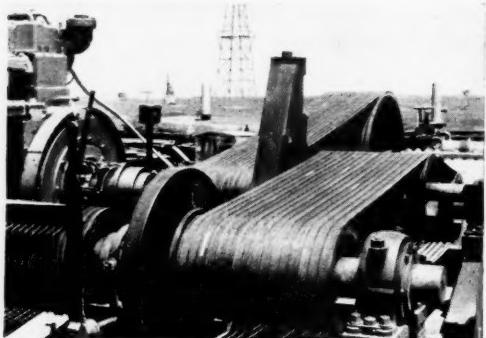
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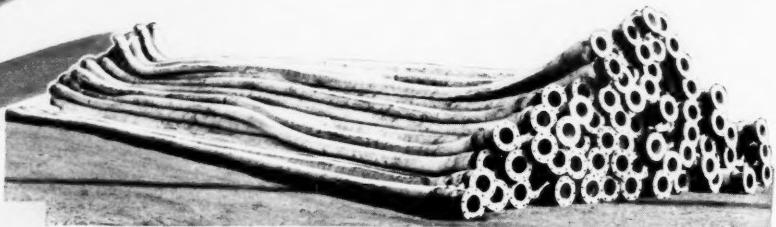
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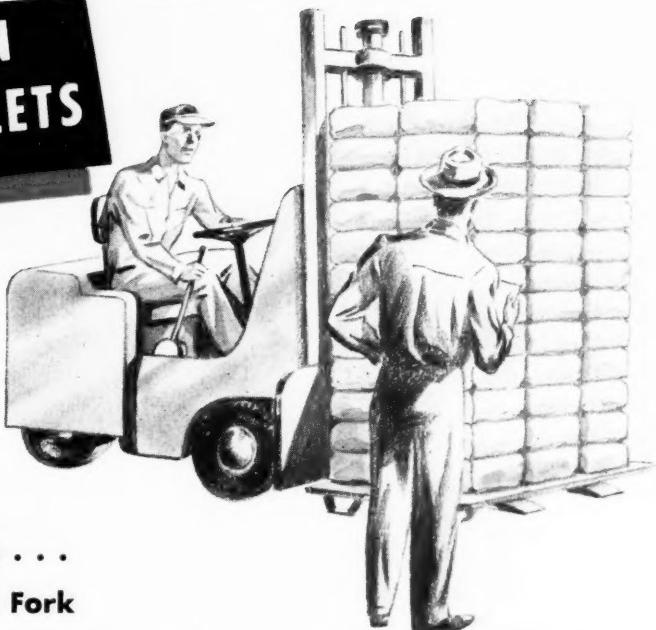
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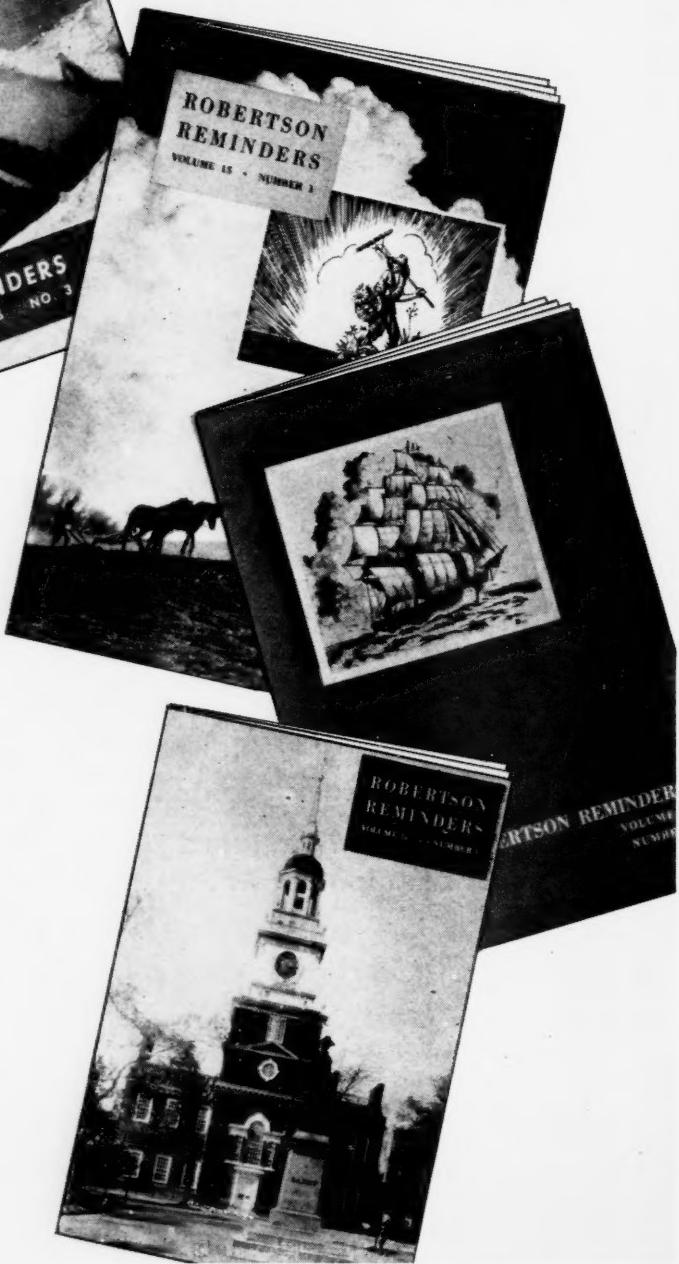
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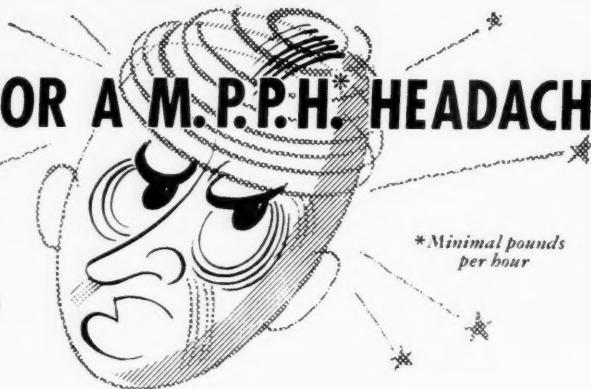
**New National Heavy Duty Tubers Can Provide the "Remedy"**

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For the new *National Heavy Duty Tubers* will produce many *more* pounds per hour at lower working temperatures than your old tubing equipment, with synthetic as well as natural stocks.

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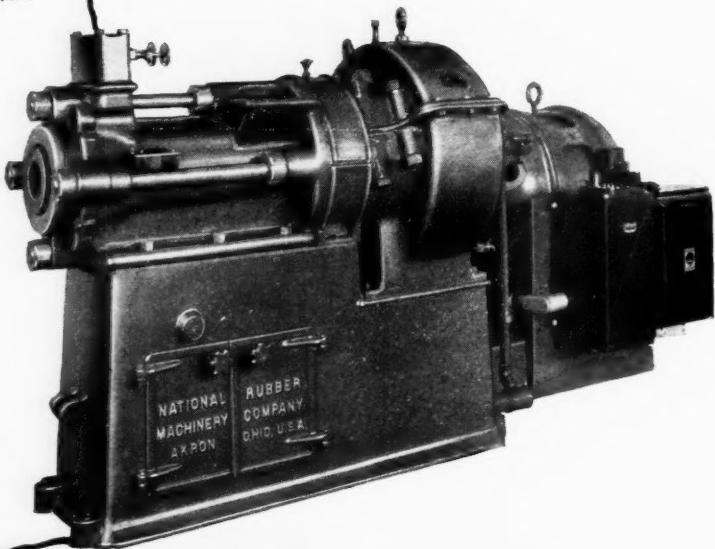


\*Minimal pounds per hour

*NRM* engineers work unceasingly for the sole purpose of building heavy duty tubing machines that anticipate the ever changing needs of the rubber industry.

*National Tubers'* advanced design and resultant economy in the use of electrical power, closer control of stock dimensions and a more accurate control of processing temperatures will insure lower production costs and a consistently better product.

A factual bulletin covering the many superior features of *NRM* Tubing Machines in models ranging from 2" to 12" screw diameters, is available to you. It will be mailed upon request.



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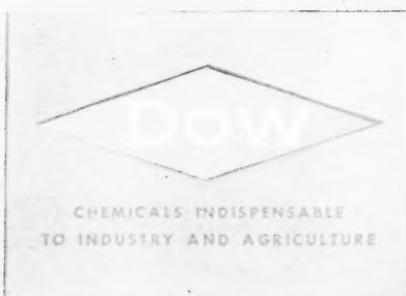
is back in carload quantities!

Methocel (Dow Methylcellulose) is used successfully in the rubber industry as a thickening agent for the control of viscosity in latices and for the creaming of latices. Methocel, a cold water soluble cellulose ether, is compatible with most rubber dispersions. Other significant advantages are its uniformity and purity and its ability to produce the creaming effect, quite readily. Methocel is available for shipment now. Take advantage of its unique properties. Write to Dow for more detailed information about Methocel and its uses in the rubber industry.

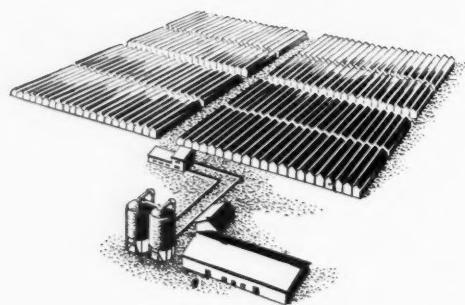
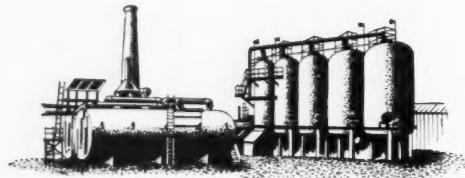
## METHOCEL ADVANTAGES

1. Methocel is compatible to an unusual degree with a wide variety of modifying agents including alcohols, wetting agents, plasticizers and resins.
2. Methocel is odorless, harmless.
3. Methocel solutions ordinarily do not require preservatives.
4. Methocel is a uniform, synthetic chemical product.
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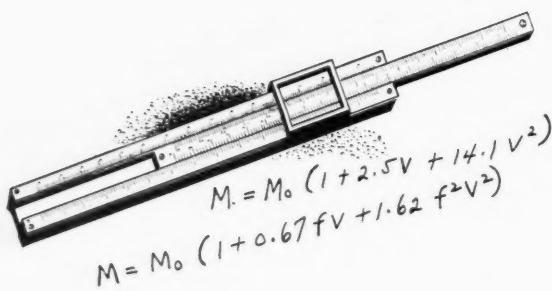
## 2. BASIC RESEARCH

Witeo's efforts are not confined to the production and quality control of its products. Contributions to general knowledge of the behavior of rubberlike materials and, in particular, of pigments in rubber are contained in papers such as the following:

The Mechanism of Reinforcement of Elastomers by Pigments. *India Rubber World*, December, 1947.

The Effect of Pigments on the Hardness of Natural and Synthetic Rubber. *Rubber Age*, July, 1948.

The Effect of Pigments on Elastomer Properties. *Proceedings London Rubber Technology Conference*. June, 1948.



# WITCO CHEMICAL COMPANY

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# the Rubber Industry...

## 3. TECHNICAL SERVICE

Witco's Technical Service Laboratory was established to serve you and to help solve your application problems. Publications covering the properties and behavior of specific Witco materials include:

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- Witco Stearates—Bulletin 46-1 (Third Edition)
- Witearb R—Bulletin 46-2
- Witco Products (Fifth Edition, 1948)
- Witco No. 30: A New Softener—Report R-6
- Reinforcing Furnace Blacks—Report R-5
- Continex FF—Report R-4



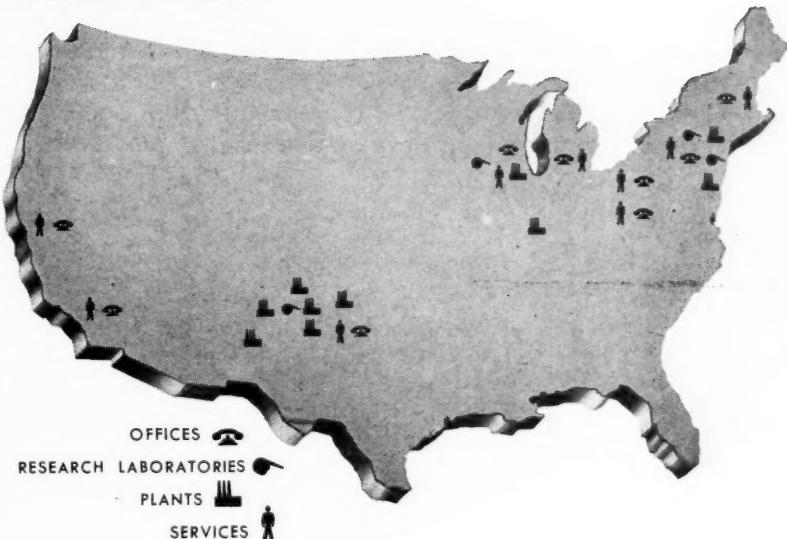
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Witco maintains four well-equipped laboratories, ten modern plants, and strategically located offices and warehouses throughout the United States and in England... to provide the fullest possible service to the rubber industry.

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**PLANTS:** Sunray, Texas (3); Witco, Texas (2); Witco, New Mexico; Perth Amboy, New Jersey; Chicago and Lawrenceville, Illinois; Brooklyn, New York.

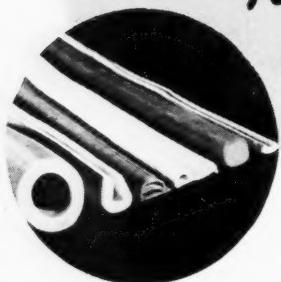


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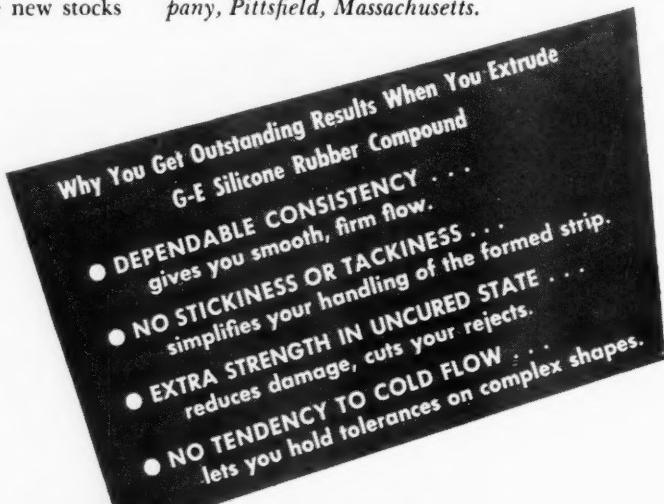


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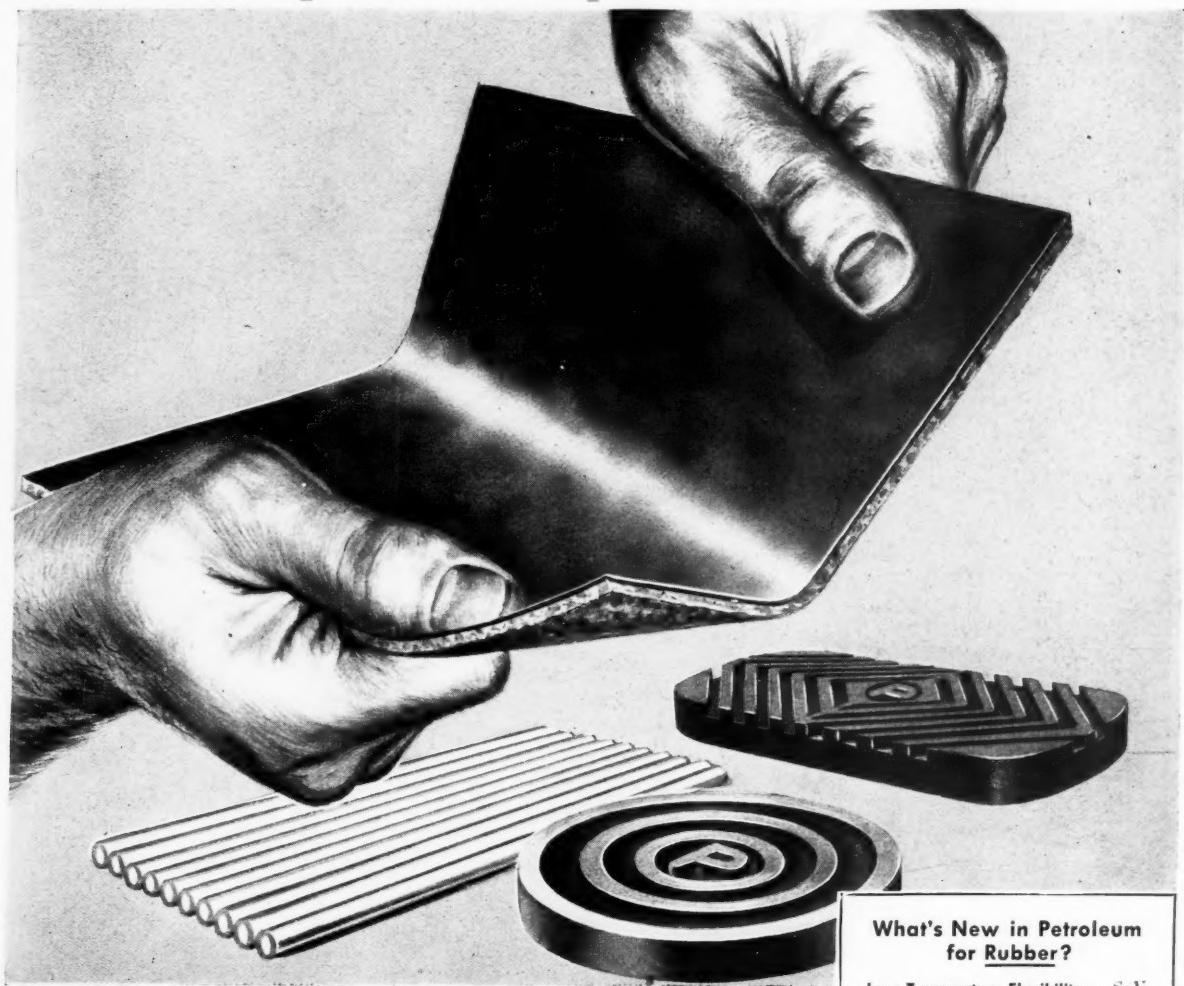
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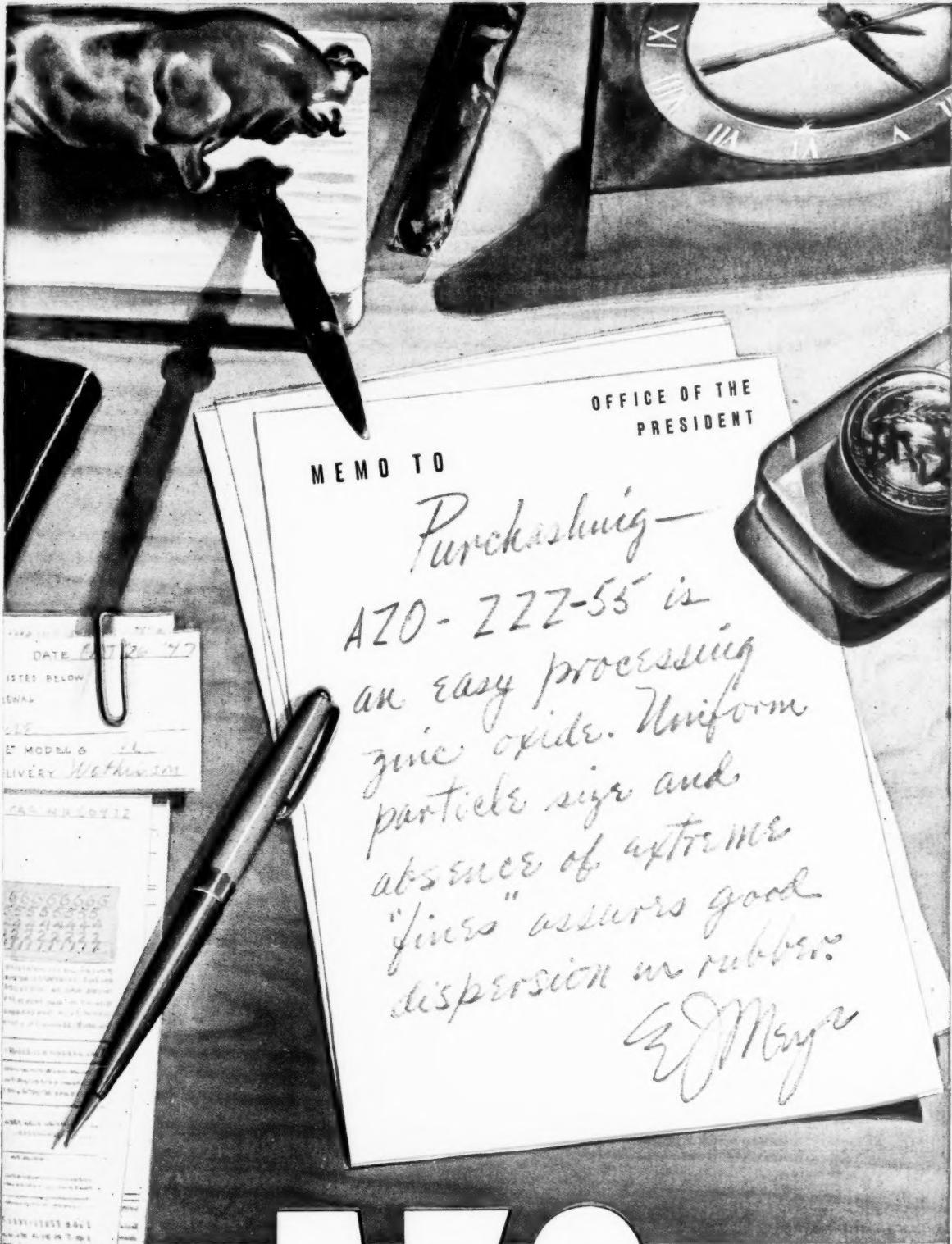
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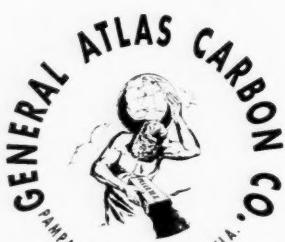
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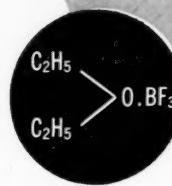
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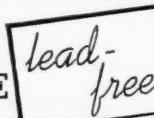
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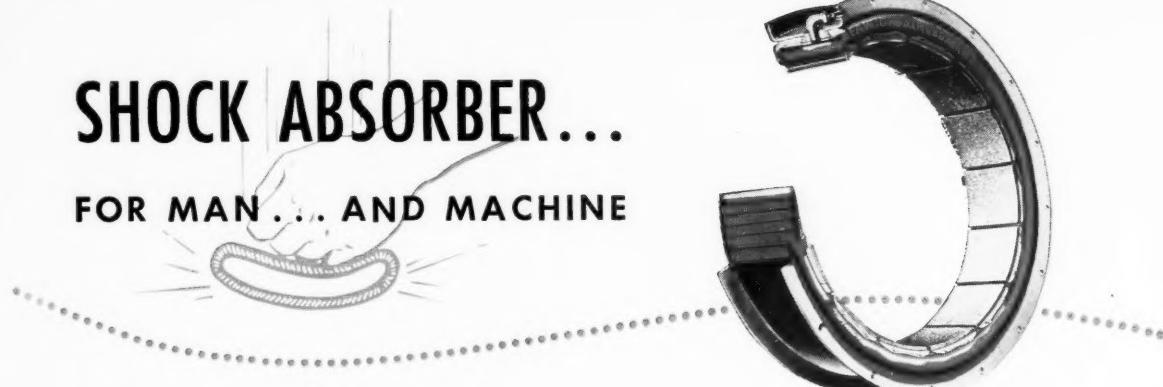
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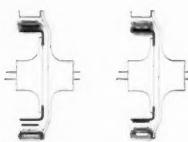
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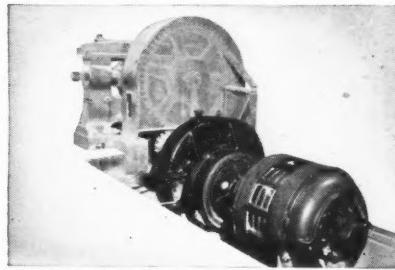
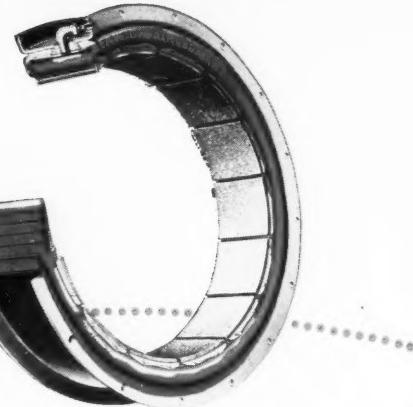
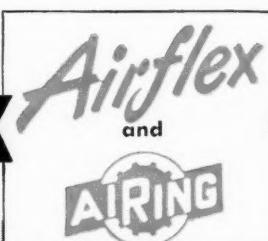
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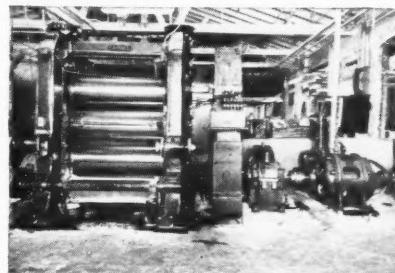
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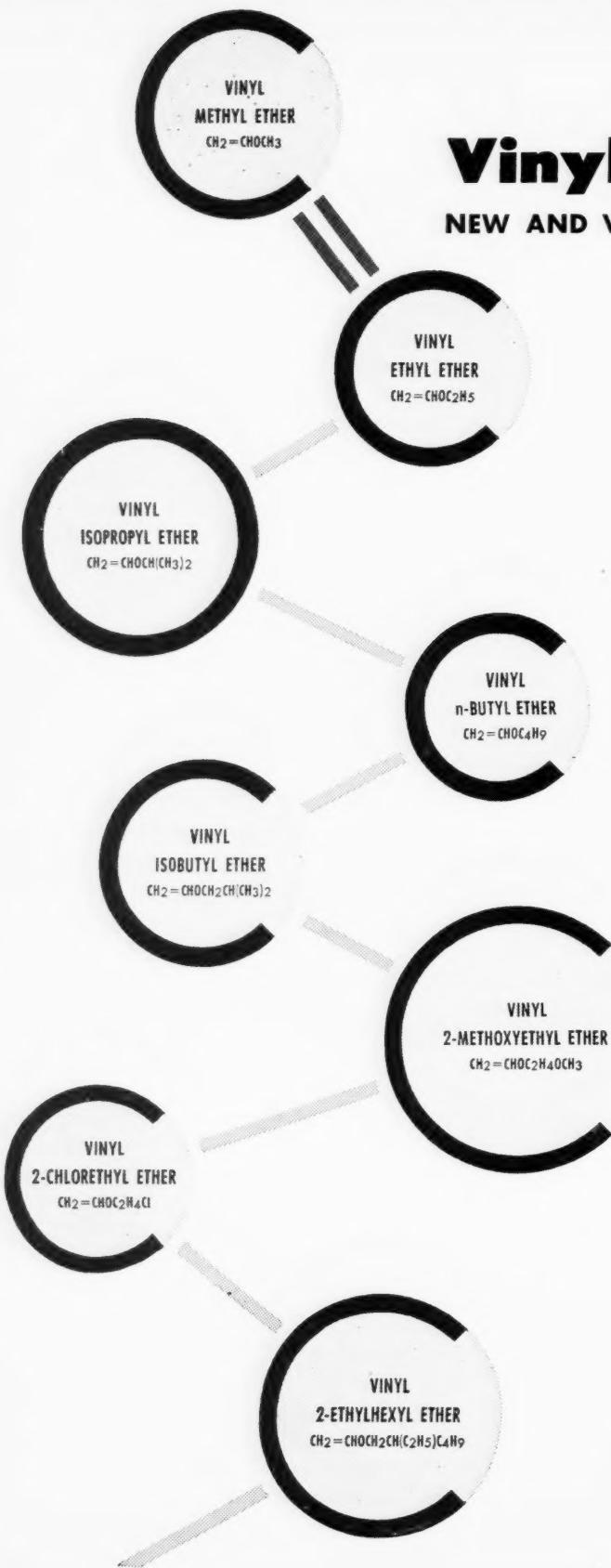
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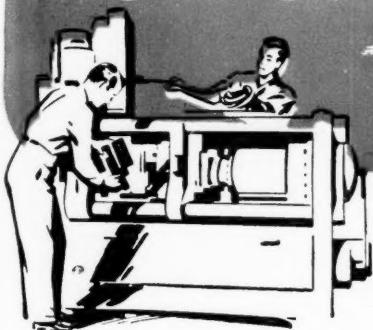
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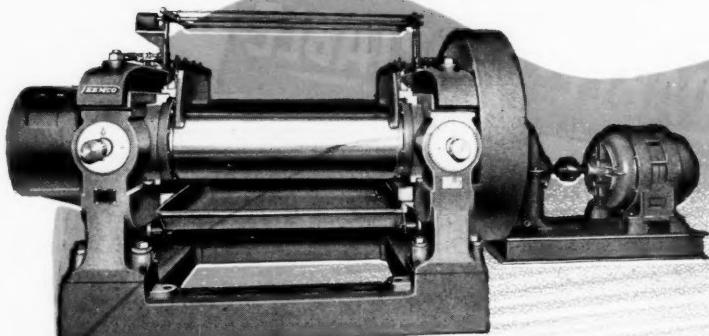
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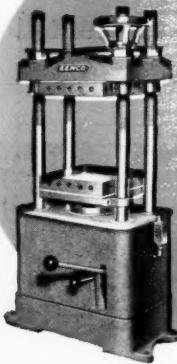
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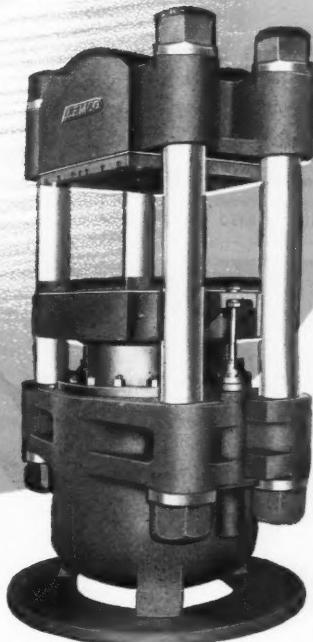
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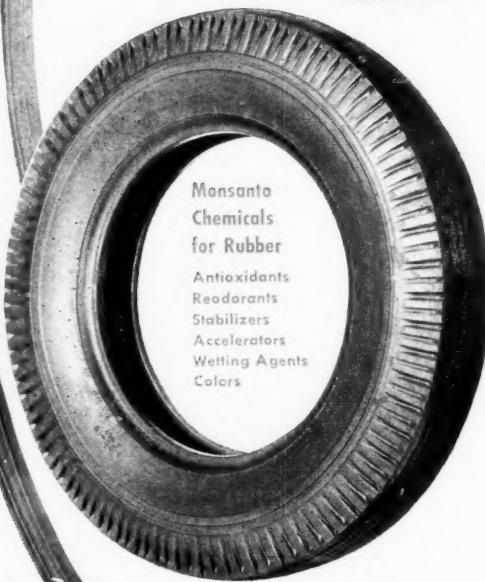
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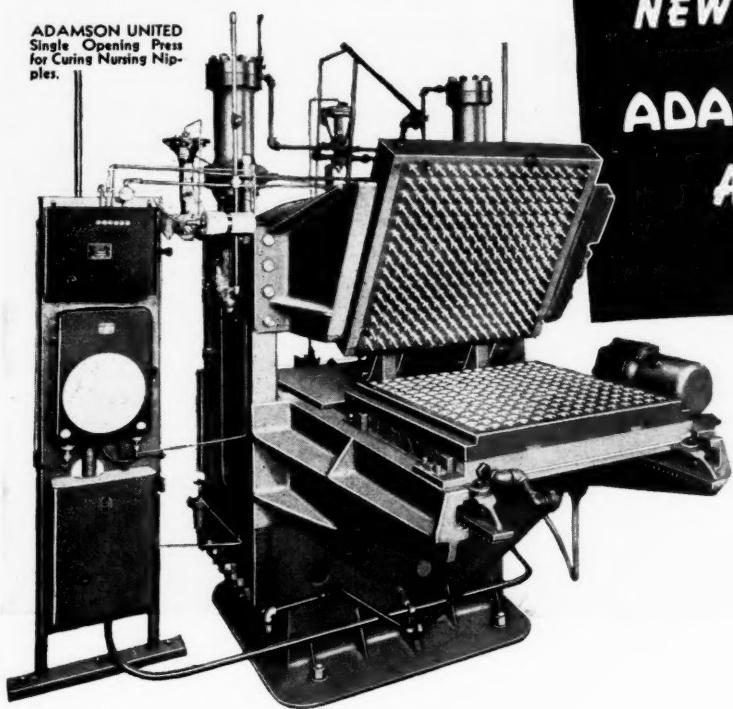
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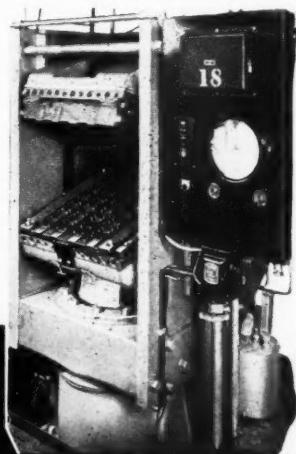
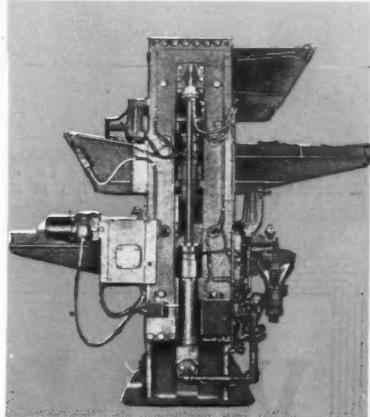
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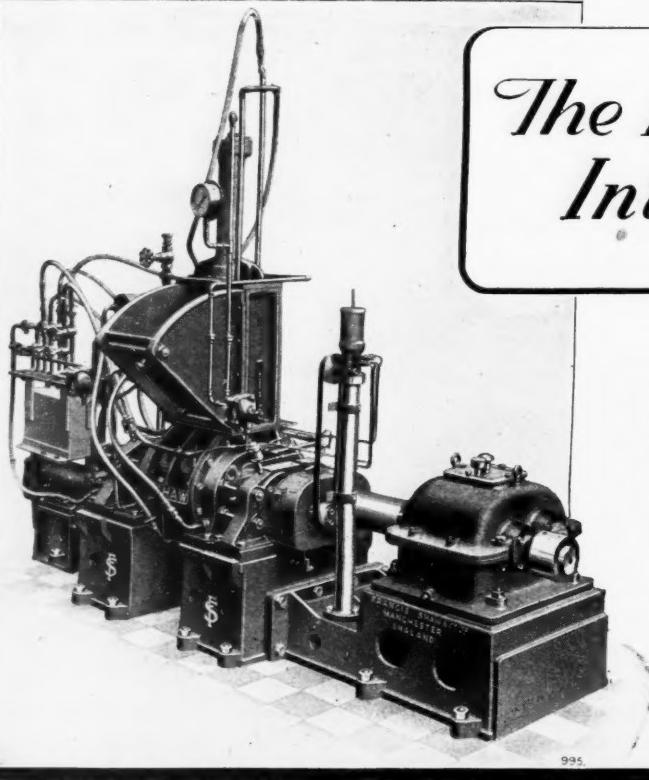
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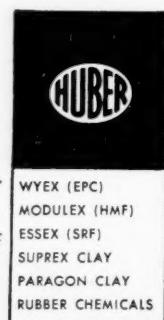
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# RUBBER WORLD

Volume 118

New York, August, 1948

Number 5

## Rubber from Goldenrod—I

F. L. McKennon, E. L. D'Aquin, W. F. Guilbeau, H. J. Molaison, J. Pominski,  
and H. L. E. Vix<sup>1</sup>

**A**S A part of the Emergency Rubber Project brought on by World War II, the United States Department of Agriculture undertook the problem of producing rubber from several of the more promising domestic plants, one of which was goldenrod (1).<sup>2</sup>

Recognizing as early as 1920 that this country would be critically affected if the supply of crude rubber from the Far East became unavailable, the government organized surveys of the sources of crude rubber and of the areas from which they came. Manufacturers became interested in widening the area where rubber was cultivated. Between 1927 and 1930 the late Thomas A. Edison, searching for a plant which could be grown and harvested in this country to produce rubber in case of an emergency, investigated thousands of different species of native plants. He finally chose goldenrod, a perennial weed-plant, for more comprehensive study and initiated cultivation tests. The approximately 400 strains selected and tested in these investigations were turned over, after Edison's death, to the U. S. Department of Agriculture for further study (1).

The Department's technological work on the production of rubber from goldenrod was begun in June, 1942. Goldenrod by then had been planted on 50 acres of land in the vicinity of Waynesboro, Ga.; the major portions of these plantings were selected strains of a variety (*Solidago leavenworthii*) (2) whose rubber content, as a result of the Department's horticultural studies, had been increased from about 1% to from 4% to 7% in the dried leaves. Preliminary experiments had indicated that the significant quantity of rubber occurred in the leaves and was negligible in stalks and stems.

The choice of a method to be used for the pilot-plant extraction of the rubber from the goldenrod leaves was inevitably limited by wartime restrictions on such materials as were required to build equipment of reasonably large capacity. This consideration was the basis for the decision that was finally made to use an eight-cell solvent-extraction unit already available at the Southern Regional Research Laboratory. The choice of a solvent method seemed warranted by the fact that Edison had isolated

rubber from goldenrod by solvent extraction. Another point which favored use of this solvent extraction equipment was the availability of similar battery-type extraction units in commercial plants operating in the Southeast which might have been adapted for large-scale production of goldenrod rubber if this had been required. Additional equipment needed for use with the eight-cell unit in the goldenrod operations was designed at the Southern Regional Laboratory and was constructed from materials on hand.

Methods such as ball milling and hydroseparation were investigated, but showed little promise. The major portion of goldenrod was processed by a basically simple method consisting of a preliminary acetone extraction of the dried leaves to remove most of the resinous material followed by extraction with benzol to remove the rubber.

### Location of Rubber in the Goldenrod Plant

The method of recovery of rubber varies considerably with the location of the rubber in different species of plants. For instance, in the *Hevea* or *Castilloa* trees rubber is obtained by bleeding the trunks. In the Russian plant, *Kok-saghyz* rubber is obtained by processing the roots. In guayule the rubber is concentrated in the trunk and roots, and very little rubber is found in the leaves. In the milkweed plant the leaves represent 50% of the dry weight and contain approximately 90% of the rubber. It was therefore necessary to make a detailed study of the location of rubber in the goldenrod plant.

To do this two methods were used, one consisting of a small-scale extraction of the rubber with benzol, and the other a microscopic examination of sections of the plant material by use of a standardized staining technique developed at the Southern Regional Research Laboratory (3). With a staining material such as Sudan 4,<sup>3</sup> the rubber particles showed up as bright scarlet and translucent; whereas resin globules were orange-red to amber and more opaque in appearance.

Both methods showed that the stem cells contained essentially no rubber and that most of the rubber was contained in the leaves of the plant. The leaf is almost typically herbaceous with a heavy midrib. The only unusual structures are "resin ducts" which occur at the

<sup>1</sup>All authors are with the Southern Regional Research Laboratory, New Orleans, La., one of the laboratories of the Bureau of Agricultural & Industrial Chemistry, Agricultural Research Administration, United States Department of Agriculture.

<sup>2</sup>Numbers in parentheses refer to bibliography references at end of this installment.

<sup>3</sup>The mention of names of commercial products of equipment in this article does not imply that they are endorsed or recommended by the Department of Agriculture over others of a similar nature not mentioned.

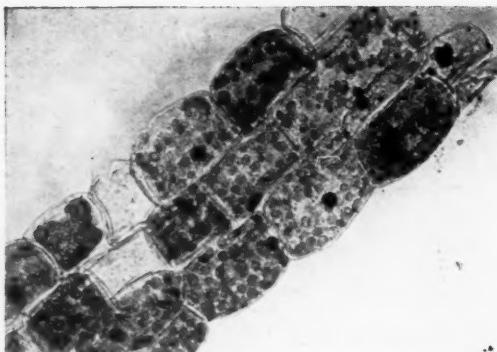


Fig. 1. Photomicrograph of Rubber-Bearing Cells of Goldenrod Leaf Showing Isolated Rubber Globules (Dark Spheres) Suspended among the Green Plastids of Each Cell (Mag. 300X)

anastomosis of the veins and seem to be reservoirs rather than continuous ducts. Rubber occurs in the form of isolated globules floating free among the plastids in the protoplasm of both palisade and spongy parenchyma cells. Occasionally as many as three or five globules can be found in a single cell; usually they occur singly and average about two microns in diameter (Figure 1). The percentage of rubber in the dried leaves was found to vary from about 4.7, and the quantity of acetone-extractable resins generally present was 2½ times as much as the quantity of rubber.

### Laboratory Investigations

The first shipment of goldenrod consisted of almost pure leaf material which had been hand-stripped. This was used in preliminary investigations, which showed that a resinous portion (4) could be extracted with acetone and that a material having some rubber-like properties could be extracted with benzol.

While infrared absorption (5) and X-ray pattern measurements showed that goldenrod rubber structure, like that of *Hevea brasiliensis*, consisted of cis-isomer polymers of isoprene, the two rubbers differed markedly in physical properties. The viscosity of goldenrod rubber solutions (6) averaged about 0.7-centipoise, as contrasted with values of 1.8 and 2.4 centipoises for *Hevea* smoked sheet and pale crepe, respectively, at the same concentration. Goldenrod rubber was more readily soluble in benzol and other rubber solvents than *Hevea* and required larger proportions of non-rubber solvents, such as alcohol and acetone, for precipitation. A relatively small fraction was obtained on fractional precipitation which had an intrinsic viscosity approaching the average of *Hevea*. In addition there was a wider range of intermediate and low viscosity fractions present in the goldenrod rubber (7).

Other X-ray examinations of the product from the goldenrod plant revealed a constituent, which may be present in a minor amount, in the unstretched state of both the raw and vulcanized rubber, of crystalline structure, but whose crystal spacings are not those of the trans-isomer, gutta percha. This substance may be a non-rubber constituent, or a polyisoprene fraction with a different structural arrangement.

From a practical standpoint the raw product obtained by evaporating the benzol extracts in vacuum resembled raw *Hevea* rubber only slightly. It was a very soft, sticky, greenish black mass, which had but little elasticity in this state. It softened almost to fluidity on heating, and stuck to both rolls of a mill, where the slightest warming, especially with added chemicals, produced a paint-like mass that could be removed only by use of a doctor blade. This raw material thus presented almost insuperable difficulties in handling even on a laboratory scale, and it appeared that the handling of large lots in the pilot-plant and for shipment would be practically impossible except as a benzol miscella, or "cement." Tensile strength measurements on vulcanizates of those samples which could be milled were so low, varying between 300 and 1300 p.s.i. (8), that it seemed questionable whether this material could be processed in such a way as to produce rubber of any practical value.

TABLE I. COMPOSITION OF A GOLDENROD TREAD STOCK

Ingredients	Precured Rubber	Material Added on Rolls	Final Composition Parts
Goldenrod rubber (resin-free)	100.00		100.00
Sulfur	0.66	2.84	3.50
Mercaptobenzothiazole	0.83	0.175	1.005
Diphenylquandine	0.33	0.47	0.80
Zinc stearate	5.50	...	5.50
Zinc oxide	...	5.50	5.50
Flectol H	0.50	...	0.50
Statex B (FF Black)	...	50.00	50.00
Resins	4.10	...	4.10
	111.92	58.985	170.905

To try toughening this material, a study was begun on "precuring" the rubber, which consisted of adding part of the vulcanizing chemicals to a benzol solution of rubber, evaporating the benzol, and heating the rubber at an elevated temperature in the vulcanizing range. By a more or less empirical study a solution method (9) of precuring using a minimum of vulcanizing chemicals was developed (see Table 1), whose advantages were found to be twofold: first, it insured excellent dispersion of part of the vulcanizing chemicals, thus eliminating points of weakness due to localized "scorch spots" in the vulcanizates; and, second, the plasticity of the partially compounded stock after subjection to elevated heat was improved sufficiently to permit easy handling. The remaining chemicals could be satisfactorily incorporated

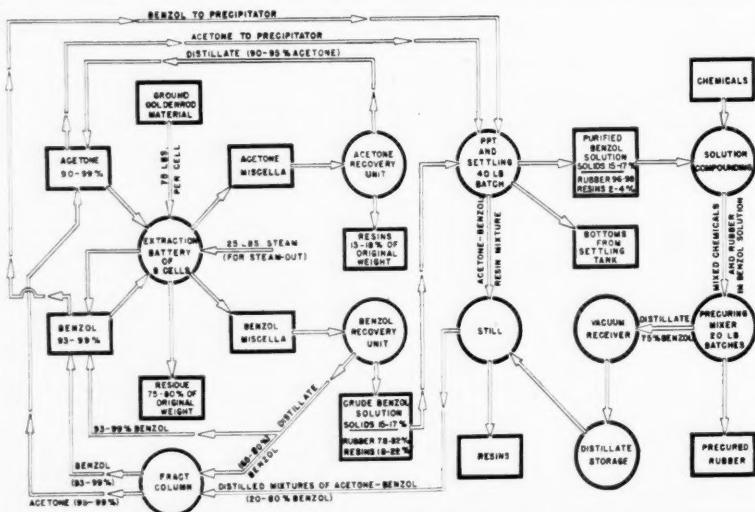


Fig. 2. Flow Chart of Pilot-Plant Process for Goldenrod Rubber

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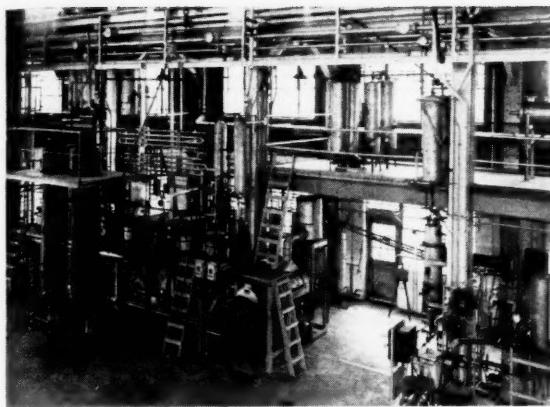


Fig. 3. Pilot-Plant Fractionation System

on mixing rolls. Vulcanizates prepared from this stock were found to have tensile strengths as high as 3000 p.s.i. at optimum cure.

#### Pilot-Plant Investigations

Figure 2 shows diagrammatically the pilot-plant process (10) used to extract and process the rubber from the goldenrod plant material. The following steps in the process are indicated: acetone extraction, benzol extraction, purification of benzol extract, and precuring operations.

Unfortunately the 1943 crop was not harvested until after blooming had set in and contained only 20 to 25% leaf material. The balance was blooms, stems, and stalks which had a very low rubber content and a high resin-rubber ratio. This mixture, used for most of the pilot-plant work was subjected to a screening process<sup>4</sup> which enriched the rubber content of the total dry material from 1-2% to about 2.7%.

For the pilot-plant runs the eight-cell battery on hand was used (Figure 3); each cell had a diameter of 12 inches and a height of about five feet and holding 75 pounds of dried screened material ground to pass through a 30-mesh screen. Two extractors were in the acetone cycle; while three were in the benzol cycle. The other three extractors were in any one of the following processes: acetone draining, benzol draining, steaming out, unloading or loading. Briefly the four main processing steps were as follows:

In the first step acetone at 140° F. was passed through the extractors for six hours at a rate of 100 gallons an hour to remove resin. This procedure removed 13 to 18% of the total starting material in the form of acetone-soluble resins.

In the second step, following the acetone extraction, benzol at 175° F. was passed through an extractor for nine hours at a rate of 50 to 75 gallons an hour to remove the rubber in the form of a benzol miscella. An antioxidant (Flectol H) was added to the miscella on the basis of 0.5% on the rubber present. Evaporation of benzol increased the rubber content in the miscella to approximately 20%.

The third step consisted in reducing the resin content of the 20% rubber miscella by precipitation of the rubber with excess of acetone. Approximately 20 gallons

<sup>4</sup> A few preliminary experiments (10) were made simultaneously on other methods for enriching the rubber content of the goldenrod plant material, including water, alkali, and acid digestion; ensiling; and retting on a large scale in that the bulk of the material and drying time were decreased with an increase in the rubber content and rate of extraction.

<sup>5</sup> Some of the goldenrod rubber, prepared in the initial stages (September, 1942) of the investigations of the Southern Regional Research Laboratory, did not produce a satisfactory blend as reported by Morris, et al. (12).

of the 20% rubber miscella and 40 gallons of acetone were placed in a 100-gallon tank and agitated for 10 minutes. After settling for an hour at 30° C., the acetone-benzol-resin solution was decanted, leaving the precipitated rubber in the tank. Such a procedure reduced the resin content of the rubber from 25 to 5%. Preliminary vulcanization tests had shown that if the resin content was in excess of five parts per 100 parts of rubber, the tensile strength and other properties were affected adversely.

The fourth step in the pilot-plant process was the precuring operation. The precipitated rubber, after step three, was redissolved in benzol to prepare a solution containing approximately 17% total solids. The amounts of chemicals used to precure 18 pounds of resin-free rubber were dissolved in two gallons of benzol and added to a solution containing this quantity of rubber. The mixture was brought to the boiling point to insure homogeneous solution of rubber and chemicals and then fed at about six gallons per hour to a steam-heated Loomis mixer, which was equipped with "sigma type" kneading blades driven by a three h.p. motor (Figure 2). Benzol was distilled from the system under about 14 inches of vacuum; the temperature was held between 140 and 170° F., at which levels no signs of gel formation were detectable. As soon as the benzol was completely distilled, the mixer was opened, and the temperature allowed to rise to about 250° F., at which elevation the material began to "set up" or stiffen rapidly. Heating was continued for about 15 minutes; the temperature rose to about 280° F. The material was then cooled uniformly until it could be lifted from the mixer. This stock was ready for compounding on conventional mixing rolls. The total amount of rubber on a resin-free basis processed in the eight-cell battery amounted to 874 pounds. Comprehensive aging tests were not made, but the precured rubber after standing for one year still produced good vulcanizates.

#### Preliminary Studies of Milling, Compounding, and Physical Properties

As soon as goldenrod rubber was available in 2-3-pound lots of a quality fairly representative of that obtainable by solvent extraction, samples were submitted to several of the largest rubber manufacturing companies who cooperated in the determination of the possibility of processing this product on factory equipment. Both raw and precured rubber were of definite interest.

Results of these preliminary processing tests indicated that:

1. Raw goldenrod rubber,<sup>5</sup> as prepared by procedure previously given, can be blended with GR-S synthetic rubber up to at least 30% of goldenrod rubber with desirable results, and that blending increases building tack, reduces absolute hysteresis, and increases elongation of the product. In addition goldenrod rubber can replace up to 20% of *Hevea* with desirable results.

2. If raw goldenrod rubber were used for blending with GR-S, a method of handling and shipping of the sticky raw rubber would have to be devised.

3. Precured goldenrod rubber has desirable properties and can be satisfactorily processed by milling, calendering, and extruding in the form of tread stock with carbon black filler.

4. By limiting the precuring to a minimum the maximum qualities of goldenrod rubber can be brought out sufficiently so that, either alone or in blends with GR-S, subsequent manufacturing operations can be made without particular difficulties.

For comparison, the results obtained on one batch of

TABLE 5

goldenrod rubber in preliminary tests at the Southern Regional Laboratory and in the laboratory of one of the larger rubber companies are reported below:

Time of Cure at 200° F. Min.	Tensile Strength, p.s.i.	Ultimate Elongation, %
	S. R. R. L.	S. R. R. L.
20	2830	3085
30	2650	3015
40	2650	3080
	500	475
	440	450

\* One of the major rubber companies.

Despite the identical curing times and temperature used at the two laboratories it will be noted that there is a difference of about 300 to 400 p.s.i. in the tensile strengths of the samples, a large part of which is probably due to the fact that cures at the industrial laboratory were made in Chelsea molds producing strips 0.1-inch thick; whereas the cures at the government laboratory were made in standard molds producing vulcanizates 0.06-inch thick.

On the basis of these preliminary tests a large number of pre-curing experiments was made in which the vulcanizing chemicals were reduced to a minimum for preparing stock that could be handled satisfactorily. The formula shown in Table 1 was found the most satisfactory for handling this material on a pilot-plant scale.

#### General Testing at the V. L. Smithers Laboratories

Approximately 50 pounds of the pilot-plant pre-cured goldenrod rubber was shipped to the V. L. Smithers Laboratories, Akron, to obtain a more comprehensive set of data for comparison of the quality of this rubber with GR-S and to determine more fully its usefulness as a blending agent. The composition of the pre-cured rubber, the amounts of added ingredients, and the final composition of the goldenrod tread stock tested at that laboratory are shown in Table 1. In Table 2 the final composition of the goldenrod tread stock is compared with that of the GR-S tread stock and those of the blends of the two rubbers.

TABLE 2. COMPARATIVE COMPOSITION OF TREAD STOCKS OF GOLDENROD, GR-S, AND GOLDENROD GR-S BLENDS

	Parts					
GR-S	50.00	62.50	75.00	87.50	100.00	
Goldenrod (precured)	111.92	55.96	41.97	27.98	13.99	
% Goldenrod	100	50	37.5	25	12.5	0
Bardol	2.50	3.13	3.75	4.38	5.00	
Zinc oxide	5.50	5.25	5.19	5.13	5.06	5.00
Sulphur	2.84	2.42	2.32	2.21	2.11	2.00
Mercaptobenzothiazole	0.175	0.84	1.00	1.17	1.33	1.50
Micromes W-6 (EPC Black)	25.00	31.30	37.50	43.80	50.00	
Statex B (FF Black)	50.00	25.00	18.75	12.50	6.20	
D. P. G.	0.47	0.24	0.18	0.12	0.06	

All materials in these recipes are proportional for each of the two kinds of rubber.

It will be noted from the data in Table 3 that 100% goldenrod tread stock can be cured sufficiently at 200° F.; the Shore hardness at 70 minutes is 71. The first batch of GR-S tested (not reported in Table 3) was found to cure sufficiently at 280° F.; the Shore hardness at 70 minutes was 67, and the tensile strength-time of cure relation was very flat between 50 and 90 minutes. It was therefore decided that an intermediate temperature should be used for the blends. Unfortunately the GR-S stock used for this investigation (Table 3) were slower curing than the original GR-S stock and was not completely cured at 280°. All of the blends were cured at both 280° and 270° for the preliminary tests. These tests indicated that the higher temperature was preferable for curing the blends for the preparation of vulcanizates for other tests, such as rebound, heat build-up, etc. Since some of the samples of the blends contain-

ing a small proportion of GR-S and the samples of 100% GR-S were undercured, it is impossible to make an exact comparison of the physical properties of these stocks from the data contained in Tables 3 through 8. In general, these tests showed that heat build-up, rebound, and tear resistance of GR-S are improved somewhat by incorporation of goldenrod rubber; whereas this procedure has the adverse effect on abrasion resistance, tensile strength, and aging characteristics.

TABLE 3. PHYSICAL PROPERTIES OF TREAD STOCKS OF GOLDENROD, GR-S, AND BLENDS OF PRELIMINARY TESTS

% Goldenrod Rubber	100*					
	0	50	37.5	25	12.5	0
Cure Min.						
Modulus at 300° F.	20	910	1230	1000	660	200
30	1180	1250	1090	910	470	120
40	1280	1390	1340	1090	700	250
50	1350	1490	1360	1210	850	380
60	1340	1550	1430	1330	950	490
70	1370	1600	1520	1370	1050	710
Modulus at 500° F.	20	1830	2410	2040	1310	430
30	2120	.....	.....	1930	1030	290
40	.....	.....	.....	2190	1470	540
50	.....	.....	.....	1820	880	
60	.....	.....	.....	2030	1260	
70	.....	.....	.....	2230	1520	
Tensile strength, p.s.i.	20	2070	2400	2460	2130	850
30	2120	2210	2230	2490	1860	630
40	2160	2000	2150	2210	2090	1190
50	2160	2050	1970	2360	2470	1700
60	2090	1930	2010	1940	2440	2420
70	2050	2000	2150	2170	2490	2620
Elongation at break	20	563	493	570	700	856
30	500	455	500	610	760	880
40	480	393	430	503	650	870
50	460	386	393	490	626	755
60	450	360	390	400	566	780
70	426	360	376	433	550	730
Shore hardness	20	64	62	59	52	39
30	67	63	60	57	49	37
40	69	63	62	59	52	40
50	69	64	63	61	56	46
60	70	65	64	61	56	50
70	71	66	65	62	58	51
Set, %	20	100	49	50	53	96
30	88	44	39	46	52	116
40	75	28	25	33	40	63
50	63	28	25	31	34	50
60	63	22	25	21	28	38
70	59	20	20	23	26	44

\* Cured at 260° F.; all others cured at 280°.

TABLE 4. PHYSICAL PROPERTIES OF TREAD STOCKS OF GOLDENROD, GR-S, AND BLENDS

% Goldenrod Rubber	100*					
	0	50	37.5	25	12.5	0
Cure Min.						
T-50 tests, °C	10	—	6	—	—	—
20	—	—	—	—	—	—
30	—	—	—	—	—	—
40	—	—	—	—	—	—
50	—	—	—	—	—	—
60	—	—	—	—	—	—
70	—	—	—	—	—	—
80	—	—	—	—	—	—
90	—	—	—	—	—	—
Permanent set, %	10	—	—	—	—	—
20	15.5	8	8	8	9.5	—
30	15.5	8	8	6.5	8	19
40	15.5	8	6.5	6.5	6.5	14
50	15.5	8	6.5	6.5	6.5	12.5
60	17	8	6.5	6.5	6.5	11
70	—	—	—	—	—	—
80	—	—	—	—	—	—
90	—	—	—	—	—	—
Pusey & Jones Indentation	10	—	—	—	—	—
20	75	90	116	239	230	—
30	67	85	91	110	158	—
40	65	82	86	96	121	—
50	63	80	80	88	103	160
60	62	78	79	85	94	137
70	—	75	78	80	90	120
80	—	—	—	—	—	116
90	—	—	—	—	—	106
A S T M hardness numbers	10	—	—	—	—	—
20	44	53	66	115	152	—
30	38	48	52	65	97	—
40	37	45	48	59	73	—
50	36	44	48	54	62	100
60	36	44	47	51	58	81
70	36	43	47	49	54	74
80	—	—	—	—	67	—
90	—	—	—	—	65	—

\* Cured at 260° F.; all others cured at 280° F.

TABLE 5. PHYSICAL PROPERTIES OF TREAD STOCKS OF GOLDENROD, GR-S,  
AND BLENDS

Averaged Cures							
$\eta_{\text{c}}$	Goldenrod Rubber	100*	50	37.5	25	12.5	0
	GR-S	0	50	62.5	75	87.5	100
Time of Cures (Min.)	40,50,60	30,40,50	30,40,50	40,50,60	60,70,80	70,80,90	
Goodrich heat build-up tests							
Static compression	0.175	0.201	0.223	0.279	0.286	0.331	
Set	3	2	2	5	7	17	
Shore hardness	70	65	63	61	60	57	
$\Delta T$	40	48	51	65	72	100	
Williams abrasion tests							
Hardness	72	65	64	60	57	55	
Index	83	100	109	155	185	303	
DeMatta flex cut growth							
No. of flexes to 0.8"	25,000	42,000	45,000	62,000	59,000	79,000	
Time of Cures (Min.)	40,50,60	30,40,50	30,40,50	30,40,50	50,60,70	70,80,90	
Goodyear Healy rebound tests							
Indentation	0.226	0.234	0.238	0.257	0.239	0.271	
Energy recovery	61.8	59.2	59.0	54.3	53.3	48.0	
Time of Cures (Min.)	30,40,50	20,30,40	20,30,40	30,40,50	50,60,70	60,70,80	
Tear tests (before aging)							
At room temperature	545	430	425	445	435	300	
212° F.	370	285	305	320	320	230	
Tear tests (aged 96 hrs. in oxygen 300 lbs., 70° F.)							
At room temperature	460	390	450	440	475	425	
212° F.	305	250	290	335	370	355	
Specific gravity	1.142	1.160	1.161	1.161	1.164	1.161	
Plastometer tests							
Mooney	2	14	13	29	39	45	
Firestone	5	5	4	11	20	46	
Williams	124-41	243-38	241-42	300-56	338-69	305-191	

\*Cured at 260° F.; all others cured at 280° F.

TABLE 6. PHYSICAL PROPERTIES OF TREAD STOCKS OF GOLDENROD, GR-S, AND BLENDS (AFTER AGING)

\*Not tested.

To check the quality of goldenrod as a gum stock, a series of vulcanizates was made by the same formula as used in the preparation of the goldenrod tread stock

except that carbon black was entirely omitted from the compounding formula. Although the physical properties of the vulcanizates of the goldenrod gum stock, shown in Table 7, were not so good as those of *Hevea* natural

TABLE 7. PHYSICAL PROPERTIES OF GOLDENROD GUM STOCK

	10	20	30	40	50	60
T-50 test °C.....	-14	-24	-28.5	-31	-31.5	
Permanent set %.....	4.5	4.5	4.5	4.5	4.5	4.5
Pusey & Jones indentation.....		199	156	149	149	146
ASTM hardness.....	115	92	85	85	84	
Goodeyey Healy Rebound						
Energy rec. °C.....	66.2	78.0	79.4			
Indentation.....	0.418	0.374	0.352			
Williams Abrasion						
Snore hardness.....	39	43	45			
Index.....	936	508	432			
Flex						
De Mattia cut growth— no. of flexes to 0.8%.....		28,000	72,000	144,000*		
Tear test at normal temp.						
Lengthwise (room temp.) .....	115	130	100			
Crosswise (room temp.) .....	105	145	70			
Lengthwise (212° F.) .....	70	75	75			
Crosswise (212° F.) .....	75	85	80			
Tear test after aging for 96 hrs. in oxygen bomb 300 lbs./70°F.						
Lengthwise (room temp.) .....	175	100	75			
Crosswise (room temp.) .....	110	75	80			
Lengthwise (212° F.) .....	90	75	80			
Crosswise (212° F.) .....	90	80	75			

Specific gravity of goldenrod gum stock, 0.999.

Plasticity of goldenrod gum stock, Firestone, 4; Williams, 80-30.

\*Test stopped at 0.78°.

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# GR-S Black 1 and GR-S Black 2<sup>1</sup>

**G**R-S Black 1 and GR-S Black 2 are latex compounded masterbatches of GR-S and EPC (Easy Processing Channel) Black, containing 50 parts and 46 parts of carbon black, respectively, per 100 parts of GR-S solids. The latex used is similar to Standard GR-S except for a lower Mooney viscosity ( $37 \pm 4$  ML 212° F. @ 4 minutes). These masterbatches are produced by blending the GR-S latex and carbon black slurry, followed by coagulation, drying, and baling.

GR-S Black 1 and GR-S Black 2 were developed to provide the rubber industry with carbon black and GR-S masterbatches which would reduce milling time and power consumption without sacrificing the quality of the finished product.

GR-S Black 1 and GR-S Black 2 are manufactured and distributed by Reconstruction Finance Corp., Office of Rubber Reserve. The bales weigh approximately 90 pounds and are packed in paper bags or supplied in bareback form, depending upon the preference of the consumer.

A relatively non-staining type, GR-S Black 1 has been made as X-413 GR-S. X-413 GR-S is the same as GR-S Black 1 except that it is stabilized with Stalite instead of phenyl-beta-naphthylamine or BLE. Other GR-S black masterbatches have been made or are expected to be made available to meet special needs of the rubber industry. These may embody changes in the contained polymer, for example, Standard GR-S type with fatty acid or GR-S-10 with rosin acid or polymers which are non-staining, masterbatched with variations in the type or proportion of carbon black.

## Special Properties

In comparison with GR-S compounds containing mill or Banbury mixed EPC Black, GR-S Black 1 and GR-S Black 2 compounds have the following advantages:

Reduced milling time.

Lower power consumption.

Increased cleanliness of compounding and mixing departments.

Greater assurance of optimum and uniform carbon black dispersion.

Simplification of material handling and storage.

## Recommended Uses

GR-S Black 1 and GR-S Black 2 are recommended for all compounds which require GR-S and EPC Black.

Large-scale users of latex-compounded black masterbatches include manufacturers of:

- Tires
- Cameback
- Mechanical goods
- Heels and soles
- Flooring
- Household goods
- Sporting goods
- Wire and cable
- Battery containers
- Miscellaneous specialties

Rubber manufacturers with shortages of milling capacity and labor can particularly benefit by the use of GR-S Black 1 and GR-S Black 2. Those who have the definite problem of cleanliness or who must handle black

<sup>1</sup> Data and information supplied by The General Tire & Rubber Co., Agent for the Reconstruction Finance Corp., Office of Rubber Reserve, in connection with the Government Synthetic Rubber Program.  
SPECIAL REFERENCE: "Incorporation of Carbon Black into GR-S Latex on a Production Scale," R. L. Rongone, C. B. Frost, G. H. Swart, *Rubber Age* (N. Y.), Sept., 1944, p. 577.

and light-colored stocks in the same factory can be aided by the cleaner mixing and compounding operations obtainable by the use of latex-compounded black masterbatches. Companies located in zones prohibited by local ordinance from mixing carbon black into rubber have used the GR-S black masterbatches to advantage.

Factory problems of material handling and storage are simplified by the use of these products, which are baled and packed in clean paper bags or are supplied without bags as bareback bales. The lower bulking factor of these masterbatches, as compared with loose black plus GR-S, can be of definite advantage from the viewpoint of handling and storage.

## Development

When synthetic rubber latex in large volume became available through the GR-S program, it appeared possible that the wartime objective of increasing rubber goods production without increasing heavy machinery and power consumption could be partially met by incorporating the necessary carbon black into the rubber while it was still in latex form. The other advantages previously discussed were also anticipated, provided the technical difficulties inherent in controlling continuous masterbatching operations were overcome.

The large-scale production of GR-S latex compounded black masterbatches was based on a development program directed toward the preparation of a suitable slurry of carbon black, blending of this slurry with GR-S latex, and coagulating the mixture to yield a coherent easily dried crumb. Commercial-scale masterbatching necessitated relatively minor additions of supplementary equipment to the existing GR-S plants with most of the new equipment being required to prepare the carbon black slurries.

GR-S Black 1 and GR-S Black 2 were developed by The General Tire & Rubber Co., Agent for Rubber Reserve. Millions of pounds of these masterbatches have been produced. Starting in August, 1944, the product was first known as X-140 GR-S and later as X-228 GR-S before finally being assigned the designation, GR-S Black 1. GR-S Black 2 was originally prepared in November, 1946, as X-348 GR-S before becoming a regular production item.



Fig. 1. Tubed Tread, Compound A. 100 GR-S and 50 EPC Black, Dry Mixed

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## Compounding and Processing Characteristics

GR-S Black 1 and GR-S Black 2 are slightly slower curing than Standard GR-S; therefore slightly higher accelerator ratios are required.

GR-S Black 2 is made to accommodate those companies desiring slightly lower carbon black ( $46 \pm 2$  parts per 100 parts GR-S) in their recipes; while GR-S Black 1 contains the more standard carbon black content of 50 parts per 100 parts of GR-S.

A comparison of the separate incorporation of EPC Black in Standard GR-S and GR-S Black 1 and GR-S Black 2 was made in a compounding and processing study. Factory-type recipes were used, as indicated below, rather than standard test recipes since complete data were sought including tire tests:

Recipe	A	B	C
Standard GR-S.....	100		
GR-S Black 1.....		150	
GR-S Black 2.....			146
EPC Black.....	50		
Zinc oxide.....	5	5	5
Petroleum plasticizer.....	7.5	7.5	7.5
Antioxidant.....	1.2	1.2	1.2
Sulfur.....	1.85	1.85	1.85
N-cyclohexyl-2-benzothiazole sulfenamide*.....	1.1	1.1	1.1
Diphenylguanidine.....		0.15	0.15
Total.....	166.65	166.80	162.80

\*Santocure was used.

The factory processing data in Table 1 illustrates the savings in both Banbury mixing time and power con-

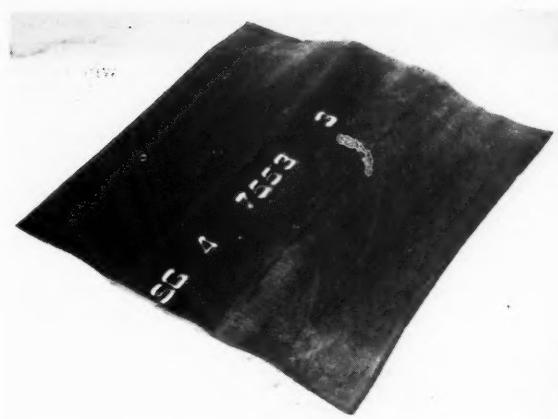


Fig. 2. Tubed Tread, Compound B, 150 GR-S Black 1, Latex Compounded

sumption obtainable by the use of GR-S Black 1. Similar results should result if GR-S Black 2 were used.

TABLE 1. TYPICAL FACTORY PROCESSING DATA

	Compound A (Standard GR-S + EPC Black)*	Compound B (GR-S Black 1)	Compound C (GR-S Black 2)
Total Banbury mixing time.....	18 minutes	11 minutes	
Total Banbury power consumption.....	54.13 KWH	22.01 KWH	
Tubing speed (fixed).....	5 treads per minute	5 treads per minute	
Tubing temperature.....	300° F.	290° F.	

\*Carbon black incorporated in Banbury.

TABLE 2. PHYSICAL TEST DATA ON FACTORY MIXED AND TUBED STOCKS

	Compound A (100 GR-S, 50 EPC Black)					Compound B (150 GR-S Black 1)					Compound C (146 GR-S Black 2)						
	50	50	44	37	37	45	60	75	20	30	45	60	75	20	30	45	60
Original (Tested @ 82° F.)																	
Tensile, p.s.i.....	415	2080	2370	2700	2400	440	2290	2820	2930	2930	300	2180	2790	2870	2770		
Elongation, %.....	900	805	650	620	570	970	810	705	630	635	1020	900	770	705	675		
Modulus (@ 300% p.s.i.).....	100	340	690	830	995	80	460	745	850	900	60	310	610	645	635		
Cure @ 287° F. (min.).....	20	30	45	60	75	20	30	45	60	75	20	30	39	37	317	318	
Original (Tested @ 205° F.)																	
Tensile, p.s.i.....	155	930	1045	955	955	230	1080	1150	1260	1150	180	930	900	1005	960		
Elongation, %.....	660	580	425	365	345	665	640	450	420	375	690	685	485	440	395		
Modulus (@ 300% p.s.i.).....	100	360	625	685	745	110	395	635	715	805	120	270	480	565	660		
Aged 48 Hrs. @ 212° F. (Tested @ RT*)																	
Tensile, p.s.i.....	2180	1725	2140	2250	2310	2160	1970	2165	2355	2270	1830	1790	2440	2260	2550		
Elongation, %.....	635	350	330	340	350	470	320	330	370	360	480	330	420	420	440		
Modulus (@ 300% p.s.i.).....	760	1410	1810	1920	1880	1165	1710	1880	1775	1760	930	1580	1480	1430	1410		
Tear (crescent), lbs. sq. in.....	441	250	239	222	240	260	210	198	234	238	278	210	234	237	240		
(Aged 48 Hrs. @ 212° F. (Tested @ 205° F.))																	
Tensile, p.s.i.....	950	750	685	735	730	615	680	830	930	930	630	655	680	640	750		
Elongation, %.....	455	255	205	200	200	225	200	210	205	230	290	205	200	200	225		
Modulus (@ 300% p.s.i.).....	450	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		

\* Room temperature.

TABLE 3. DYNAMIC PHYSICAL TEST DATA ON FACTORY MIXED AND TUBED STOCKS

	Compound A (Standard GR-S + EPC Black)				Compound B (GR-S Black 1)				Compound C (GR-S Black 2)			
	45	75	45	75	45	75	45	75	45	75	45	75
Cure @ 287° F. (minutes).....	45	75	45	75	45	75	45	75	45	75	45	75
Initial temperature, ° F.....	95	91	212	212	96	96	212	212	87	89	212	212
Hardness (durometer-Type A).....	60	63	64	65	61	61	61	64	60	60	59	60
Static compression, %.....	15.2	12.2	18.3	14.9	18.6	14.3	17.2	18.0	19.2	19.4	24.4	18.7
Test duration (minutes).....	21	18	30	30	21	30	30	30	24	18	27	30
Temperature rise, ° F.....	88	74	79	67	82	76	83	75	86	72	103	77
Height change, %.....	9.3	4.4	19.3	12.8	4.1	2.5	18.0	12.7	6.4	2.2	25.7	17.2
Permanent set, %.....	13.4	3.8	29.0	18.5	10.0	3.1	29.5	20.5	12.0	3.5	blowout	24.5
Test temperature, ° F.....	RT†	212	RT†	212	RT†	212	RT†	212	RT†	212	RT†	212
Cut growth (inches per 1000 flexes).....	.056	.198	.063	.219	.040	.188	.063	.281	.029	.177	.050	.250
Goodyear-Healy, %.....	53.9	55.4	54.9	56.4	54.9	56.4	54.9	55.9	54.4	55.9	54.5	54.2
Bashore, %.....	39.5	40	41	41.5	41	41.5	41	42	41.5	42	41.5	42

\*Test run with 140-pound load and 0.175-inch stroke on cylindrical specimen one inch high and 0.7-inches in diameter.

† Room temperature.

In Figures 1 and 2 the improvement in appearance (smooth contours) of factory mixed and extruded treads obtained through the use of GR-S Black 1, when compared with separate incorporation of carbon black in similar recipes, may be noted.

### Physical Properties

In Table 2 stress-strain results, tear strength, and hardness data on the factory mixed and tubed stocks described in the previous section are reported. Analysis of these data shows that for these physical properties in a similar recipe GR-S Black 1 and GR-S Black 2 are equivalent to Standard GR-S into which the same carbon black has been incorporated by separate mixing.

The dynamic properties, as measured by the Goodrich flexometer, De Mattia flexometer (cut growth), and the Goodyear-Healy and Bashore resiliometers (rebound) and recorded in Table 3, also indicate that there is little variation between these compounds.

In view of the data presented in Tables 2 and 3 it becomes apparent GR-S Black 1 or GR-S Black 2 can be utilized in many applications without degradation of the properties in the end-product.

The standard recipes with physical tests and the specification limits which are used to control the quality and reproducibility of GR-S Black 1 and GR-S Black 2 are given in Table 4.

TABLE 4. SPECIFICATION PHYSICAL PROPERTIES

Recipes*	GR-S Black 1	GR-S Black 2
Masterbatch.....	150.0	146.0
Softener (BRT No. 7).....	5.0	5.0
Zinc oxide.....	5.0	5.0
Sulfur.....	2.0	2.0
Mercaptobenzothiazole.....	1.5	1.5
	163.5	159.5
GR-S Black 1	GR-S Black 2	
Average Production Data‡	Average Production Data‡	
Specification†	Specification†	
Properties of vulcanizate @ 82°F.		
Tensile strength, p.s.i.		
50° cure @ 292°F..... 2600 min.	2950	2500 min.
Elongation, %..... 600 min.	670	600 min.
Modulus @ 300% elongation, p.s.i.		
50° cure @ 292°F..... 200-500	405	225-525
50° cure @ 292°F..... 650-1050	865	550-950
90° cure @ 292°F..... 900-1400	1185	725-1225
Mooney viscosity compounder†		
ML 212°F. @ 4..... 43-51	47.2	41-49
	44.6	

\* Standard Rubber Reserve compounding agents.

† Details in "Specifications for Government Synthetic Rubbers," Jan. 1, 1947.

‡ Specification test data, average production values (Baytown).

### Chemical Properties

The chemical properties of GR-S Black 1 and GR-S Black 2 including average production data obtained during specification testing are presented in Table 5.

TABLE 5. CHEMICAL PROPERTIES

	GR-S Black 1	GR-S Black 2
Specification*	Average Production Data‡	Average Production Data‡
Ash (total).....	1.25 max.	0.78
Soap.....	0.50 max.	0.05
Volatile matter.....	1.00 max.	0.18
ETA extract.....	7.00 max.	4.70
Fatty acid, range.....	2.50-4.00	3.19
Stabilizer.....	Not specified	1.45
Carbon black.....	32.4-34.2	33.2
	30.5-32.4	31.5

\* Details in "Specifications for Government Synthetic Rubbers," Jan. 1, 1947.

† Specification test data, average production values (Baytown).

### Availability

GR-S Black 1 and GR-S Black 2 are available in car-load lots or less and may be obtained upon application to the Sales Division, Office of Rubber Reserve, RFC, 811 Vermont Ave., N. W., Washington 25, D. C.

## Rubber from Goldenrod

(Continued from page 659)

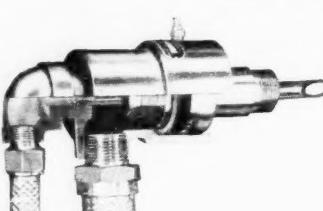
TABLE 8. EFFECT OF AGING ON GOLDENROD GUM STOCK

No Aging (Tested at Room Temperature)						
Min. at 260°F.	Tensile Strength, P.S.I.	Elong.	Mod. 500	Mod. 300	Shore Hardness	Set %
10	1600	743	360	150	35	50
20	1820	673	620	240	40	53
30	1680	605	930	280	43	49
40	1330	540	1040	330	45	31
50	1510	545	1050	330	46	25
60	1250	520	1140	330	46	28
70	1390	550	1080	310	47	28
Aged 96 Hours O <sub>2</sub> Bomb at 158°F. and 300 Lbs. Pressure						
10	1750	570	1210	380	48	28
20	1460	500	1460	430	48	28
30	580	370	....	220	50	13
40	510	345	....	430	50	13
50	570	360	....	410	50	13
Aged 7 Days Geer Oven at 158°F.						
10	1990	600	1120	370	46	56
20	1780	500	1780	490	50	41
30	470	283	....	51	14	
40	570	350	....	50	13	
50	430	310	....	390	50	
Aged 8 Hours Air Bomb at 260°F. and 83 Lbs. Pressure						
10	110	40	....	....	30	3
20	160	20	....	....	36	3
30	140	20	....	....	37	3
40	170	40	....	....	40	3
50	150	55	....	....	40	3

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(To be continued)



Cut-Away View of All-Purpose Ball Bearing Rotary Union

### Rotary Union

A NEW all-purpose ball bearing rotary union, developed by Perfecting Service Co., Chicago, Ill., features a monel metal bellows, which eliminates the need of spring loading and provides self-adjusting pressure on extra-heavy service.

bringing friction drag down to a new low. This union is suitable for introducing steam or coolants into rotary drums such as are used on paper machines, driers, calenders and coaters, printing presses, rubber-making cylinders, textile dry cans, slingers, etc. The ball bearing construction permits considerable savings in horsepower, and the flexible hose eliminates the need of complicated piping and supports.

# New Tire Developments<sup>1</sup>

A. W. Bull<sup>2</sup>

AS AN introduction to the discussion of new developments in tires, it is advisable to review some of the fundamentals of tire construction. Everyone knows what a tire looks like in external appearance, but few are familiar with its internal structure. Figure 1 shows a tire, tube, and rim in cross-section. The purpose of a tire is to float a vehicle on an air cushion. If air at least one inch thick could be attracted to a wheel to form an increasingly dense packing of air around the surface, it would have all the benefits of a tire without its disadvantages, but since absorbed air films on surfaces are only a few molecules thick, this type of air cushion is not practically possible. It is therefore necessary to depend on a layer of compressed air held inside a flexible container or tube, which serves only to hold the air. To withstand the forces resulting from this air pressure in the tube, there must be provided a strong but flexible casing or envelope. In the tire business this part of the tire is referred to as the "carcass." It consists of closely spaced layers of strong cords, ordinarily made of cotton or rayon. In passenger tires there are usually four layers of cords insulated from each other by thin layers of rubber compounds to allow flexibility without any chafing between cords. These cords have to be anchored to some rigid support which is provided by two bundles of very strong wires called bead wires. An outer sheath covers the carcass with a thick layer at the top to give the tread. The tire is mounted on a rim or wheel.

## Tire Construction Details

The tire structure is roughly similar to a suspension bridge, as shown in Figure 2. The comparison, while not strictly accurate, is sufficiently close for this discussion. In a suspension bridge the roadway and its load are carried by relatively light, vertical cables which are attached to the main supporting cables. If the bridge and the tire are compared and in imagination the cables of the suspension bridge are extended to form a complete circle, it is seen how the bead wires and cords in the tire resemble the cables of the suspension bridge in principle. In the tire the air pressure is exerted in all directions so that the cords are being pushed out into a circular shape. One important difference between the tire and the bridge is that in the tire the cord path is not directly from one bead to another, but is curved, as shown in Figure 2, to give maximum lateral stability and to distribute the stresses to better advantage.

The elements of a tire must meet the following requirements:

(a) The bead wires in the tires must have the necessary strength to withstand all the loads transmitted to them by the thousands of cords which are anchored at the beads. The individual turns of wire must also be protected from chafing. This protection is effected by encasing the individual turns of wire in a layer of rub-

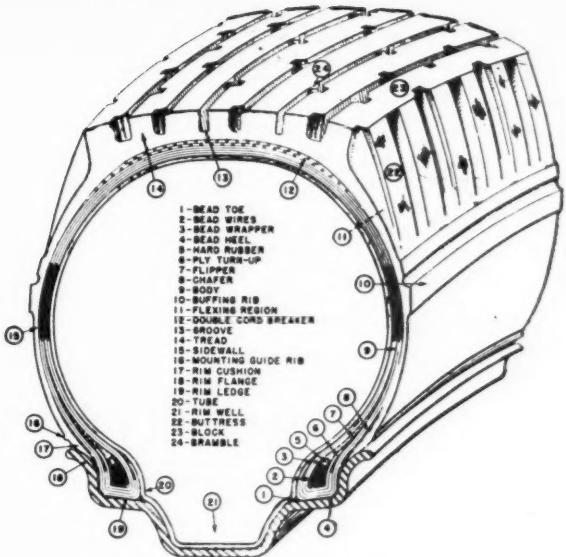


Fig. 1. Tire, Tube, and Rim in Cross-Section

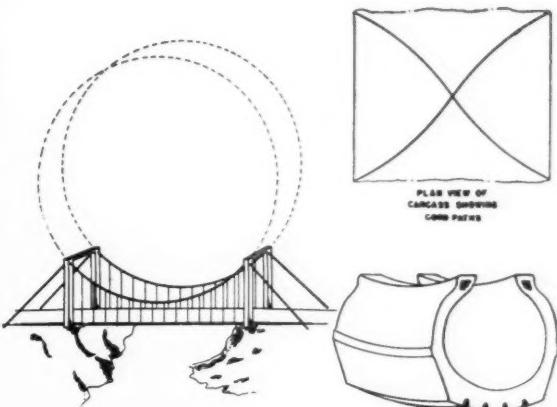


Fig. 2. Comparison of Tire with Suspension Bridge

ber which has been compounded to become relatively inflexible when the tire is vulcanized.

(b) The tire cords must have maximum strength, great flexibility, some stretch and high fatigue resistance because they also will be subjected to millions of cycles of changing elongation and stress. They must function over temperatures ranging from -40 to 300° F. because tires become extremely hot internally when operated under high speed and overload conditions.

(c) The breaker of the tire, which incorporates additional layers of cords or fabric placed directly under the tread, provides additional resistance to rupture or bruise when the tire is run over large stones or other obstacles.

(d) The tread has to serve a number of important functions. First, it acts as a weatherproof cover over the carcass to protect the cords. Second, it provides frictional contact with the road through which all the steering, braking, and driving forces are exchanged between the car and the road. Finally it must have superlative resistance to abrasion. No material is known which will withstand repeated road impacts and friction as well as rubber.

The inner tube is considered not as a tire element, but as part of the tire assembly. Its function is to hold air. It must be capable of considerable elongation because it

<sup>1</sup>Presented before Detroit Rubber & Plastics Group, Detroit, Mich., May 21, 1948.

<sup>2</sup>Director of development, tire division, United States Rubber Co., Detroit, Mich.

will be considerably larger when inflated and pushed down into the rim than when it is first inserted into the casing. It must also stand flexing for millions of revolutions.

### Tire Quality Factors

Now that the different portions of a tire have been enumerated, an examination of the factors which determine tire quality is in order. They can be classified under several headings. (Figure 3.) When all of these items are taken into consideration, it can be seen that tires must meet many requirements which the user may never have considered, perhaps because they have been taken care of adequately. One of the difficulties in the tire business is that many of these factors of quality are hidden. No man can tell from the external appearance of two tires which will do the better job or by how great a margin. A tire which looks massive and strong may actually be made of inferior materials or be so overloaded with a thick heavy tread that it will blow out long before it has delivered satisfactory mileage.

All of these factors have been intensively studied in the development of tires. The tire industry can show a record of improvement in the quality of its products and reductions in cost which can be matched by few other industries. Figures 4 and 5 show how quality has improved over the years with corresponding reductions in cost.

In tracing new developments it is necessary to point out that the war caused tremendous upheaval and confusion in the tire business, primarily because rubber, the basic raw material of the industry, was suddenly cut off by enemy action. The history of the development of synthetic rubber in this country to a point where its production took care of our essential requirements is a dramatic story of scientific and engineering accomplishment of which every chemist and engineer can well be proud.

Although the synthetic rubber produced during the war was sufficiently good to carry us to victory, it had certain serious deficiencies. One of these is the phenomenon of hysteresis which can be thought of most simply as internal friction. It is easiest illustrated by the simple experiment of dropping balls of different rubber compounds on a hard surface. A ball made of a good rubber compound returns to approximately two-thirds of the height from which it was released. A ball made of a synthetic tread compound has a much smaller recovery. This fact means that a much larger portion of the energy put into the second ball in lifting it to the point at which it was released has been converted to heat

#### FACTORS WHICH DETERMINE TIRE QUALITY

PERFORMANCE	SAFETY	COMFORT
RATE OF WEAR EXHAUSTION OF WEAR FREEDOM FROM CHIPPING OR CUTTING FREEDOM FROM CRACKING OR CUT GROWTH	SIDE RESISTANCE DIRECTIONAL LATERAL TRACTION + CARCASS SAFETY AGAINST BLOWOUTS SIZE OF BLOWOUTS WHEN THEY OCCUR PERFORMANCE AFTER BLOWOUTS	RIDING QUALITY ALL TYPES OF SURFACES DEFLECTION RATE SILENCE STRAIGHT AHEAD ON TURN ON BRAKE APPLICATION ON EXPANSION JOINTS STONE RETENTION CAR RADIO INTERFERENCE
CARCASS FREEDOM FROM ALL FAILURES BURETTE SEPARATION ENDER FABRIC SPOT BREAK BEAD TROUBLES RETREADABILITY		STATIC SHOCK
POWER CONSUMPTION EFFECT ON GAS CONSUMPTION HEAT BUILD UP & TREAD WEAR	CONTROLLABILITY STABILITY INC. DRIFT ROLL	
TUBE PERFORMANCE MOUNTING PROBLEMS RATE OF AIR LOSS & FREQUENCY OF INFLATION PUNCTURE RESISTANCE GROWTH YEAR RESISTANCE KNOB RESISTANCE	BALANCE TRAMP OR SHIMMY EASE OF STEERING PARKING	BEAUTY GENERAL APPEARANCE MAINSPEECH OR IMPLIED STRENGTH ANTI-SEED APPEARANCE COLOR PERMANENCE OF COLOR WHITE SIDEWALLS DECORATIONS
WEIGHT SPECIALLY IN AIRPLANE TIRES		

Fig. 3. Tire Quality Factors

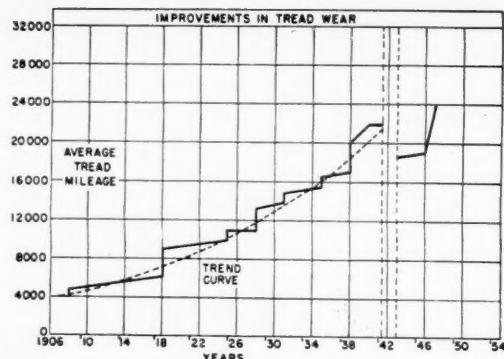


Fig. 4. Milestones of Tire Progress—Improvements in Tread Wear

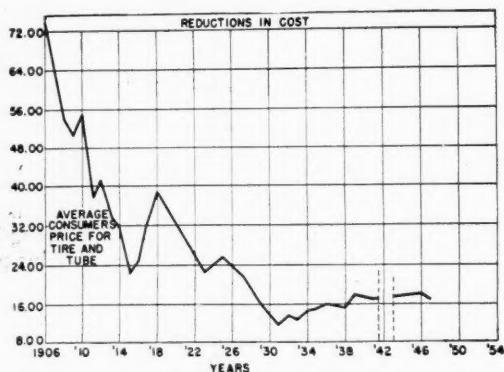


Fig. 5. Milestones of Tire Progress—Reductions in Cost

as a result of internal friction within the ball.

This excessive heat development, coupled with poor physical properties when it became overheated, constituted the major problem in the preparation of tires from synthetic rubber. The first tires which were made of synthetic showed very poor performance. Through extensive research in which all of the major companies and the government cooperated closely, means were found by which reasonably satisfactory tires could be made. This improvement has continued since the war, and as it became possible to put increasing amounts of natural rubber into the tire at critical points, performance requirements have been met.

The excessive generation of heat in synthetic rubber led to one of the most important new developments in tires. When it was found that synthetic rubber tires were going to be handicapped by this excessive heat generation, an extensive examination of possible solutions to this problem was begun. In addition to broad studies covering changes in compounds or materials in the various parts of the tire, the question of the best proportion between the cross-section of the tire and the amount of tread was carefully restudied.

### New Developments

The load carrying ability of a tire is largely determined by its cross-section. The larger cross-sections contain more air and, when operated at lower pressures, will provide better cushioning with less severe bending of the sidewalls. However it has been the practice for years to maintain an approximately uniform relation between the width of the tire tread and the cross-sectional diameter of the tire. Therefore if larger tires are put on a vehicle to overcome excessive heat generation, the larger cross-section is handicapped by the larger

tread. Rubber is a good heat insulator; hence thicker and wider treads largely offset the benefits of the larger cross-section.

With these facts in mind the United States Rubber Co. decided to depart from the conventional proportions of tread and carcass widths. A variety of tires with different ratios of tread to carcass widths was studied. As this work developed, it became clear that a new tire was being evolved which had additional major advantages. By using a larger cross-section and a relatively narrow tread, there was a major improvement in the handling qualities of cars equipped with these tires. The cars were more stable. They responded more surely to steering, especially at high speeds. The major advantage, however, was in riding comfort. The larger, softer tires operating at lower air pressure soaked up the more troublesome road shocks and gave an improvement in ride that could only be appreciated by actual experience with the tire. The lower pressure also improved the resistance of the tire to rupture, and because of the narrower treads the objective of cooler running tires was achieved.

After proving that these advantages would apply to tires made of either synthetic or natural rubber, U. S. Rubber introduced this tire of new design in September, 1946. It was called the "Air Ride" and was publicized through nationwide advertising. To gain experience on this new tire in the hands of the public, it was first introduced as a replacement tire. It should be emphasized that this new tire does not require special rims to secure its advantages. It has been and is being used on a wide variety of rims in a wide range of sizes.

After a year of experience with this tire in the replacement field it was adopted as original equipment on new vehicles by a considerable portion of the automotive industry, and its use will be further extended in 1949 models. Meanwhile new size markings and nomenclature to designate this new type of tire have been adopted by The Tire & Rim Association, Inc., and all manufacturers of tires for original equipment are in production with a tire of this kind.

Where this type of tire was used to replace directly the higher-pressure tires on the same vehicle, the new tires were, of course, subjected to the same load. In this replacement the cross-section of the new tire was a full size larger than its predecessor. When these new low-pressure tires were given new size markings by The Tire & Rim Association, new load ratings were calculated which raised the maximum load rating of these new tires about  $4\frac{1}{2}$  over the previous standard formerly used for determining the rated carrying capacity of tires. Therefore, when the new tires are placed on a car at their rated loads, they are already overloaded  $4\frac{1}{2}$ , judged by previous standards.

It is, therefore, extremely important that rated loads should not be exceeded on new cars because if these extra-low-pressure tires are required to carry overloads as great as in some cases in the past, the new tire will give unsatisfactory service. This point is particularly true in respect to irregular tread wear, flat spots, and axle vibration variously referred to as thump, tramp, or shimmy.

Since the history of this tire has been discussed in connection with the problems inherent in synthetic rubber, it is desirable to continue with a discussion of the present status of synthetic rubber. While the GR-S made during the war saved this country from the disaster which would have accompanied a paralysis of its transportation system, it was generally agreed that this material was poorer than natural rubber in at least four

important respects: (1) heat generation; (2) abrasion resistance or tread wear; (3) cracking or the rapid extension of cuts; (4) tensile strength, especially at high temperatures. During the war many variations of the standard material were tested, and research was going on which has now begun to pay dividends. By far the most important development has been the very recent change in manufacturing technique in which the copolymerization of butadiene and styrene is carried on at much lower temperatures than those previously used. This low-temperature copolymerization produces a changed structure in the polymer which makes it much more valuable for use in tires. Latest test results on GR-S prepared by this process show that major improvements have been obtained in all four of the properties previously mentioned. On the basis of these tests it seems certain that tread compounds can be made of synthetic rubber which will outwear the best natural rubber compounds. This condition, of course, has tremendous implications. If these early results are confirmed by full-scale experience, GR-S will be in a much better position to compete with natural rubber, and it brings much closer the day when synthetic rubber can stand on its own feet economically without the need of government support.

Along with the new developments in tires there should be mentioned the question of the best material for inner tubes. During the war it was found that Butyl rubber possessed outstanding properties for use in inner tubes. As a result, Butyl rubber has been used for this purpose practically to the exclusion of all other materials. It is better than natural rubber for inner tubes in many ways. First, it has better resistance to aging, both at high temperatures and over longer periods at lower temperatures. This has been important, especially in heavy-service inner tubes where high temperature aging is quite a factor. Second, it has better tear resistance, which means that tubes are less liable to tear when punctured or run flat. Therefore a larger percentage of them can be repaired. This same property also is of advantage when a tube is punctured because a butyl tube squeezes tighter around a nail or other puncturing object and reduces the loss of air compared with a natural rubber tube under the same conditions. It has been a frequent experience that Butyl tubes which have been punctured with large nails will hold up long enough to permit the driver to reach a service station, thereby avoiding a tire change on the road. Finally, and probably the major advantage of Butyl, is its superior air retention. Air diffuses through all tube materials, largely by a solubility effect. Under pressure, air dissolves in the inner surface of the inner tube, passes through the tube material while in solution, and escapes from the tube at the outer surface. Air is much less soluble in Butyl than in natural rubber, and Butyl tubes hold air at least ten times as well as natural rubber tubes. This property has made it unnecessary to reinflate Butyl tubes as frequently as natural rubber tubes, and this condition has enabled the average car owner to maintain more nearly constant operating pressures. In fact, the rate of air loss from Butyl tubes is so low that any indication of a soft tire with a Butyl tube is usually an indication of a leak which should be located and repaired.

In spite of all these advantages Butyl rubber is now being questioned as a tube material because of one major disadvantage, called "cold weather buckling." Butyl rubber does not preserve its elasticity so far down the temperature scale as does natural rubber. At sub-zero temperatures Butyl becomes less and less elastic. When passenger tires containing Butyl tubes are subjected to temperatures below zero, particularly below  $-20^{\circ}$  F.,

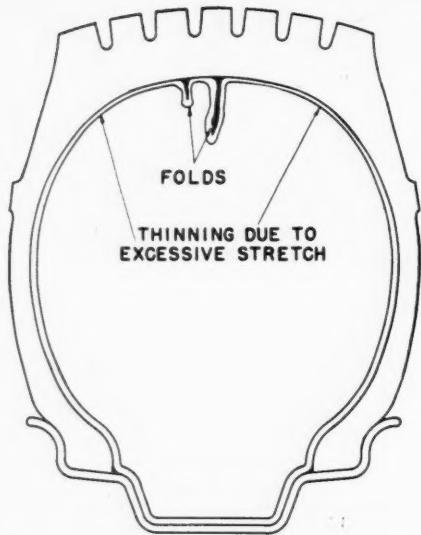


Fig. 6. Example of "Cold Weather Buckling" of Butyl Inner Tube

a curious phenomenon occurs. Butyl rubber, having lost most of its elasticity, resists the compression which normally occurs at the crown of the tube as it passes through the point of road contact. As this spot on the tube moves away from the road contact area, it does not return to its previous position. The next time the same spot passes through the deflection area a second compression occurs, and the wrinkle gets a little larger. This action will continue under severe conditions until the wrinkles or buckles, which are internal, as shown in Figure 6, grow as much as an inch in depth at the crown of the tube. Meanwhile, an equivalent amount of material has been pulled up from the shoulder area of the tube so that thinning occurs. When the buckled portion is rotated rapidly, centrifugal force causes it to chafe against the rest of the tube. Eventually this action will rub a hole in the tube with subsequent deflation of the assembly.

A good deal of work has been done to overcome this handicap of Butyl rubber. To date much progress has been made. However during this last winter many complaints of failures came from colder areas, such as Minnesota, North Dakota, and Montana. Buckling of the tube occurs much less frequently if sufficient inflation pressure is maintained. Such buckling occurs only rarely at 30 pounds' pressure, but quite rapidly even at 0° F. if the pressure falls lower than 20 pounds. Because of higher operating pressures, buckling does not occur in heavy-service tubes. As a result of this cold weather trouble with Butyl tubes, natural rubber tubes are being offered in the northern areas of this country, and there has been some pressure to go back to natural rubber for all passenger tubes. There are good reasons from a military point of view why the use of Butyl rubber should be continued. It seems unwise to abandon a material which gives superior performance for about 90% of all tube requirements, especially when it is probable that work already done or in progress will produce a satisfactory solution to the "cold weather buckling."

Another new development in tires deserves mention. It is the use of steel cord or cable in place of our standard textile materials, such as cotton or rayon. This problem has been under consideration for quite a few

years. Tires are now being made in which steel cord replaces cotton or rayon cord with a marked improvement in performance. Steel cord is much stronger, having about six times the breaking strength of rayon cord of comparable size. It is possible to make large truck tires of steel cord with but a fraction the plies that would be used in a rayon tire. Furthermore steel cord preserves its strength at high temperatures; while all textile materials lose strength with increase in temperature. Thus, if steel cord and rayon cord tires are built to have the same strength when cold, the steel cord tire will be nearly twice as strong as the rayon cord tire at an operating temperature of 300° F. The steel cord tire also shows less growth in service than the tire made of textile materials, and this advantage is a major one in reducing tread cracking. Based on the steel cord tires already built and tested, the outlook seems favorable. Currently, steel wire costs so much more than textile materials that steel cord tires are comparatively expensive. However, if this steel cord tire gets into large-scale production, there is a probability that this cost penalty can be reduced considerably.

While this discussion covers only a few of the highlights in new tire developments, it indicates that the tire industry is still making progress in its efforts to give the customer more miles, more comfort, and more safety for his tire dollar.

### Correction

Certain errors in the article entitled, "Basic Reactions Occurring during Rubber Reclaiming—I," by D. S. le Beau, which appeared in the April, 1948, issue of India RUBBER WORLD, pages 59-65, require correction as follows:

1. On page 61, second column, eighth line, the word "would" should be changed to "could."
2. On page 62, second column, fifteenth line, the words "this reclaim" should be changed to "the extract."
3. On page 63, second column, fifth line, eliminate the phrase "the experimental reclaim prepared from" and change the next word from "vulcanized" to "unvulcanized."
4. On page 65, first column, thirty-first line, "C=C" should be changed to "C=O."

### Rubber Industry in Siam

The Government of Siam has appointed a committee to confer with representatives of the Allies disposing of enemy property in order to fix the price of shares held by Japanese in the Thai Minerals & Rubber Co., with a view to acquiring the whole of the company's shares. At present the Siamese Government owns half the shares; while the other half was formerly held by Japanese. The factory manufactures processed rubber articles, rubber shoes, soles, and products used by the States railways. Should funds become available, the government plans to produce passenger-car and bicycle tires for domestic use.

Judging by recent exports, Siam's potential production of Hevea rubber must now be in the neighborhood of 100,000 tons a year. In the first four months of 1948, she exported 33,248 tons of rubber, the bulk of which went directly to the United States, with a small balance going to Singapore.

Russia is trying to import unlimited quantities of rubber, tin, and coconut oil from Siam, the director of the Siamese Government Purchasing Bureau is reported to have revealed in Singapore. It is added that Czechoslovakia has also been making offers for Siamese tin and rubber.

# Lignin as a Stabilizer for GR-S<sup>1</sup>

**T**HE problem of securing a suitable stabilizer for GR-S, where non-staining and non-discoloring characteristics are required, is one that has up to now been solved on the basis of compromise. Many of the stabilizers possessing good age resistance have been found unsatisfactory in staining and discoloration; and those possessing superior staining and discoloration properties leave much to be desired in the way of age resistance.

In a search for an improved "non-staining" stabilizer, unoxidized soda pulp lignin, such as that produced by the Howard Smith Paper Mills, Ltd., under the trade name, "Tomlinite," has been found to possess an excellent balance of properties. In addition the abundance of lignin available and its low cost give an added interest to the use of lignin for this purpose, in view of the short supply of most presently used stabilizers.

In previous evaluations of non-staining stabilizers insufficient attention has been paid to the ability of the stabilizer to retain the physical properties of the rubber. An exception is a report by Arundale, Briggs, and Shaw, Standard Oil Development Co.<sup>3</sup> In this study, consideration was given to this matter, both in the raw polymer state and in the vulcanized article.

GR-S latex was taken from the discharge of the continuous polymerization unit operated by Canadian Synthetic Rubber, Ltd., shortstopped and stripped of unreacted monomers. The stabilizer emulsion was added to the latex, which was coagulated, washed, and dried in the conventional manner.

The stabilizers used for comparison with lignin are those commonly used in "non-staining" types of GR-S and include:

1. Stalite, used in GR-S-50.
2. Hydroquinone, used in GR-S-21.
3. R-2015, manufactured by the Goodyear Tire & Rubber Co., used in GR-S-X-385.
4. UBUB, manufactured by Naugatuck Chemicals, Ltd., used in GR-S-X-386 and elsewhere.
5. Di-tertiary butyl hydroquinone.

Hydroquinone was used to the extent of 0.3-part per 100 parts GR-S. In all other cases the stabilizer was used to the extent of 1.5 parts per 100 GR-S. This amount is in accordance with Rubber Reserve practice.

Besides the above, compounds were made using pale crepe without added stabilizer as a control for color comparisons, and using standard Polysar-S, containing BLE, as control for age resistance. BLE and phenyl-beta-naphthylamine are used interchangeably in GR-S and are considered equivalent as stabilizers.

## Raw Polymer Stability

### Oven Aging

A commonly used method of measuring raw polymer stability is to follow change in Mooney viscosity with raw polymer aging. Apart from the inherent lack of reproducibility of Mooney viscosity determinations on softened polymers, this test is objectionable owing to the fact that GR-S on heat aging goes through a hardening (gelation) and a softening (breakdown), simultaneously, with the softening condition predominant in the early portion of the aging period, and the hardening

<sup>1</sup> Presented before Rubber Division, Chemical Institute of Canada, Montreal, P. Q., June 9, 1948.

<sup>2</sup> Polymer Corp., Ltd., Sarnia, Ont., Canada.

<sup>3</sup> Private communication.

G. S. Murray<sup>2</sup> and W. H. Watson<sup>2</sup>

in the later portion. The transition point varies with different stabilizers and at different temperatures, making it difficult to interpret the data.

A more satisfactory test is to follow the change in intrinsic viscosity, a measure of molecular weight, with age. The advantages of this test are many. Intrinsic viscosity is a more accurate and reproducible value.

The test requires only a small amount of polymer; thus it is relatively easy to insure uniform treatment of the test samples. The change in properties with age is steady in the same direction, and spurious results are, therefore, easy to detect.

Crumb samples of the test polymers were placed into an air-circulation oven maintained at 60° C. The polymers were sampled at regular intervals, and intrinsic viscosity was determined on the samples.<sup>3</sup> The intrinsic viscosity results are as shown in Table 1.

TABLE 1. INTRINSIC VISCOSITY  
SAMPLES AGED IN AN AIR-CIRCULATION OVEN AT 60° C.

	Hours Aged	Unaged	24	48	72	144
Lignin.....		2.15	2.15	2.15	2.14	2.06
Stalite.....		2.12	2.16	2.06	2.02	1.95
UBUB.....		2.09	2.10	2.01	2.01	1.95
BLE.....		2.07	2.07	1.92	1.92	1.80
Hydroquinone.....		2.11	2.10	2.06	1.96	1.60
R-2015.....		1.92	1.92	1.51	1.46	1.07
DTBHQ.....		1.83	1.48	0.68	0.33	0.33

In addition, samples of the lignin-stabilized polymer and Polysar-S were placed into an air-circulation oven at 70° C. The intrinsic viscosity results are shown in Table 2.

TABLE 2. INTRINSIC VISCOSITY  
SAMPLES AGED IN AN AIR CIRCULATION OVEN AT 70° C.

	Hours Aged	Unaged	24	48	72	144
Lignin.....		2.25	2.26	2.25	2.26	2.22
BLE.....		2.19	1.74	1.28	1.19	0.36

As can be seen, lignin is exceptional as a stabilizer at 60° C. and loses none of its effectiveness at 70° C.

Samples were placed into an air-circulation oven at 100° C. After 24 hours the BLE-stabilized polymer was melted and darkened. The lignin-stabilized polymer had not changed color and had merely surface hardened.

It would appear from these data that lignin used as a stabilizer in GR-S should adequately protect the polymer during long-time, raw polymer storage, even in hot climates, and the superior protection offered at elevated temperatures should allow high temperature processing with a greater margin of safety.

### Cold Milling

It is, of course, undesirable that a stabilizer offer resistance to polymer breakdown on cold milling. To determine this influence 350 grams of the polymer were milled on a cold mill (water 70° F.) set to give a small rolling bank. After five minutes' milling, sufficient stock was removed for a Mooney viscosity determination, and the mill opening was narrowed to restore the rolling bank. This procedure was repeated after 10, 20, and 45 minutes. The viscosity values are shown in Table 3.

TABLE 3. MOONEY VISCOSITY OF POLYMERS SUBJECT TO COLD MILL BREAKDOWN

	Stabilizer						
Mooney ML-4 Lignin	Stalite	UBUB	BLE	Hydroquinone	R-2015	DTBHQ	
Unmilled	54.0	51.5	55.0	50.5	50.5	42.0	40.5
Milled 5 mins.	40.0	38.0	41.5	40.5	39.0	31.5	29.0
10 mins.	36.5	36.0	37.5	37.5	35.0	29.5	28.0
20 mins.	33.5	31.0	33.0	34.0	31.0	25.5	25.0
45 mins.	27.5	27.0	27.0	28.0	25.5	21.0	20.0

The low, unmilled Mooney viscosity values for the polymers stabilized with R-2015 and DTBHQ may indicate that these stabilizers tend to promote heat softening during the drying of the polymer. In any event there is no significant difference in effect of milling in any of the polymers. In each case the Mooney viscosity after 45 minutes' milling is about half the original Mooney value.

## Stability of the Vulcanized Compounds

### Resistance to Oven Aging

The polymers were compounded in the standard Rubber Reserve tread recipe and cured for 60 minutes at 292° F. (optimum for Polysar-S, with BLE). The cured test strips were aged in an air-circulation oven at 100° C., in accordance with ASTM test method D473-45.

**STRESS-STRAIN.** The retention of tensile strength and elongation is shown in Table 4. A consideration of these data indicates that lignin is at least as good as the best of the presently used stabilizers.

TABLE 4. RETENTION OF STRESS-STRAIN PROPERTIES—VULCANIZATES AGED IN AIR-CIRCULATION OVEN AT 100° C.

Stabilizer							
Tensile % Retained	Lignin	BLE	Stalite	UBUB	DTBHQ	R-2015	HQ
Days Aged 4	79	62	65	67	70	61	64
14	56	57	50	49	—	51	48
Elongation % Retained							
Days Aged 4	31	32	33	32	23	27	28
14	14	20	16	16	13	15	13

**CRESCENT TEAR STRENGTH.** The retention of tear strength with age is shown in Table 5. As can be seen, lignin-stabilized polymer is significantly superior in this respect.

TABLE 5. RETENTION OF TEAR STRENGTH—VULCANIZATES AGED IN AIR-CIRCULATION OVEN AT 100° C.

Days Aged				
Stabilizer	2	4	7	14
Lignin	66.7	57.7	49.0	42.8
BLE	58.5	46.7	42.5	37.5

Data are available to show that lignin-stabilized polymers are equivalent to standard GR-S in retention of flex life and resilience properties upon aging at 100° C. in an air-circulation oven.

### Resistance to Cracking Due to Sunlight and Ozone

The lignin-stabilized polymer and standard GR-S were compounded in a typical sidewall recipe, and the cured strips were stretched over a frame, to 20% elongation, and exposed to sunlight at an angle of 45 degrees on the laboratory roof, in accordance with ASTM test method D518-44.

After four days linear cracks were evident; the intensity was less for the lignin-stabilized polymer. It was noticed also that the lignin-stabilized polymer retained its gloss to a much greater extent than did standard GR-S as the exposure was continued.

### Influence on Rate of Cure

It is desirable that the stabilizer should have a mini-

mum effect on the cure rate of the polymer. In order to determine the degree of such influence, the modulus at 300% elongation for the 60-minute cure of the above compounds was determined. The values are shown in Table 6. The probable testing error is about  $\pm 35$  p.s.i.

TABLE 6. MODULUS AT 300% ELONGATION AT 60-MINUTE CURE

	P.S.I.
DTBHQ	1355
Hydroquinone	1186
BLE (Polysar-S)	1169
Stalite	1082
Lignin	1069
R-2015	1056
UBUB	1056

It can be seen that Stalite, lignin, R-2015, and UBUB retard slightly as compared to BLE. This retardation in Stalite is recognized in that the modulus specification for GR-S-50 (stabilized with Stalite) is lower than for standard GR-S, but this retardation is not sufficiently serious to warrant accelerator adjustment.

### Resistance to Atmospheric Aging

The polymers were compounded in the white test recipe recently accepted as standard by the Committee on Specifications and Test Methods of the Office of Rubber Reserve. This recipe is shown in Table 7.

TABLE 7. RECIPE FOR COMPARISON—PIGMENTATION, STAINING, AND DISCOLORATION

Polymer	100
Zinc oxide	5
Titanium oxide	10
Light calcined magnesia	5
Sulfur	2
Captax	1

Cure for 50 minutes at 292° F.

The light pigment loading affords a better comparison of the color changes in the polymer. The light calcined magnesia is added to increase the physical properties of the cured compounds.

The cured sheets were placed on the laboratory roof and left there for the month of March. During this period they were exposed to very bright sunlight as well as rain and snow. It had been our intention to measure the discoloration as well as the change in physical properties, but the samples had become so weather-stained that a color comparison was not attempted. The change in physical properties after the roof exposure is shown in Table 8.

TABLE 8. EFFECT OF AGING FOR ONE MONTH EXPOSED TO THE SUN AND THE ATMOSPHERE

Stabilizers						
% of Unaged Properties	Lignin	UBUB	R-2015	HQ	Stalite	DTBHQ
Tensile strength	73	35	28	31	40	59
Elongation	74	81	75	75	51	70
Modulus 300%	110	106	133	125	109	112

As can be seen from the data, lignin is superior to the other stabilizers in this test. Some of the "non-staining" stabilizers are unsatisfactory under such aging conditions. Pale crepe, unstabilized except for the natural stabilizers present in the rubber, was also compounded in this recipe. The polymer had degraded to such an extent that it did not warrant testing after the aging period.

### Pigmentation, Discoloration, and Staining

The three discoloration characteristics of a stabilizer that need to be examined are as follows:

(a) Pigmentation, or the color imparted to the unexposed, cured compound.

(b) Discoloration, or the color developed in the cured compound upon exposure to ultra-violet light.

(c) Staining, or the color imparted to adjacent material in contact with the cured compound.

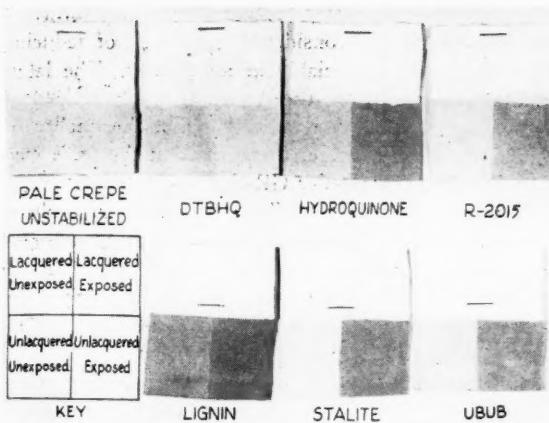


Fig. 1. Comparison of Different Stabilizers in Pigmenting, Discoloring and Staining under Sunlamp

To illustrate this point let us consider a white sidewall tire. Pigmentation is undesirable because it would require excessive amounts of expensive, white pigments to mask the pigmentation and secure the desirable whiteness. Discoloration in ultra-violet light is undesirable because the sidewall would thereby discolor when the tire was exposed to sunlight. Staining is undesirable and would occur even though non-staining materials were used in the white sidewall compounds, if materials were used in the compounds adjacent to the sidewalls which had a tendency to stain. In this latter case pigmentation is of no account because the compounds are mostly black anyway. For the same reason discoloration would not be serious, but care must be taken to be sure that no staining ingredients find their way into compounds used in the black parts of white sidewall tires.

Staining can be tested by plying a white stock of known non-discoloring quality against a compound containing the test material. It may also be tested by applying a coating of lacquer to the cured test sample and exposing the lacquered surface to ultra-violet light.<sup>4</sup> The latter method was chosen for the tests reported in this paper.

Test samples, three by 2½ inches in size, were cut out of the white stock. Half of each sample, comprising 1½ by 2½ inches, was coated with lacquer. The lacquer used was prepared by the National Bureau of Standards, Washington, for the Office of Rubber Reserve and was designed for such testing purposes. The basic materials were Tennessee Eastman cellulose acetate and titanium dioxide in a solvent mix. This lacquer showed good opacity and no discoloration whatever when a sample on aluminum foil was exposed for 48 hours under the sunlamp.

After half of each of the samples was lacquered, an area 1¼ by three inches was covered with aluminum foil so that when the samples were exposed, half of the unlacquered area and half of the lacquered area would be protected from the light. In this way it was possible to secure in one sample a section unlacquered and unexposed; a section unlacquered and exposed; a section lacquered and unexposed; and a section lacquered and exposed. This set-up can best be seen in Figure 1. Thus on a single test piece you can determine pigmentation, discoloration, and staining. Samples were exposed seven inches below an RS-type sunlamp for eight hours and for 24 hours, being rotated on a turntable to assure uni-

form exposure of all samples. Unfortunately the detail of Figure 1 affords a poor picture of the relative merits of the stabilizers. While the color differences can best be compared on samples exposed for eight hours, it was necessary for contrast to use the 24-hour exposures to secure sufficient contrast for the picture.

### Pigmentation

Lignin shows a pronounced tendency to pigment the compound. This would render lignin unsuitable for white stocks; however it should be quite satisfactory for colored compounds, even pale shades. Work done in this laboratory on the use of lignin as a reinforcing agent shows that large volumes of lignin can be faded out with white pigments.

### Discoloration

All samples, including the unstabilized pale crepe, showed discoloration in eight hours, some of them severe in 24 hours under the lamp.

Lignin appears dark in this picture, but it must be remembered that the color here is the sum of the pigmentation and discoloration. When this fact is taken into consideration, the amount of discoloration is not serious. In other words, when the proper pigments have been added to secure the desired color in a compound made from a lignin-stabilized polymer, it should not change noticeably upon exposure.

### Staining

Hydroquinone, lignin, DTBHQ, and unstabilized pale crepe were exceptional in this test and should give no difficulty whatsoever in compounds adjacent to white stocks.

The opacity of the lacquer protected the samples completely, as was indicated by the fact that peeling the lacquer off the samples showed the rubber underneath to have no discoloration; nor was there discoloration on the underside of the peeled lacquer.

The pigmenting, staining, and discoloring tendencies of lignin-stabilized polymers can be further reduced by decreasing the amount of lignin to 0.5-part per 100 parts rubber where extreme age resistance is not required.

The work described in this paper has been done using lignin incorporated into the latex prior to coagulation. For reasons not yet known the lignin does not give the same properties when added to the rubber on the mill. Possibly this condition is due to dispersion difficulties similar to those encountered using lignin as a reinforcing agent, where no reinforcement is obtained unless the lignin is added to the GR-S latex before coagulation.

### Summary and Conclusions

Summarizing the work, it may be said that unoxidized soda pulp lignin, when used as a stabilizer for GR-S to the extent of 1.5 parts per 100 parts of rubber, imparts age resistance to the polymer superior to that of the presently used standard stabilizers. In addition the non-staining and non-discoloring characteristics are equivalent to the presently used "non-staining" stabilizers. While the greyish cast produced by lignin makes it unsuitable for bright white stocks, it will not impair its use in colored compounds or in non-staining compounds.

### Acknowledgments

Acknowledgment is due to T. L. Davies, supervisor of the pilot plant, where the polymers were made, and to N. R. Legge, head of the physical research section, for valuable assistance in interpreting the test data.

<sup>4</sup>Proposed by Rubber Reserve Committee on Specifications and Test Methods for Synthetic Rubbers.

# EDITORIALS

## Costs, Prices, and Profits

THE industrialist, the owners of large as well as small concerns, the merchant, and in fact almost all of us are today faced with a serious dilemma. In manufacturing, distribution, services, and in all types of activity where it is essential to maintain the proper relations between the three base factors of costs, prices, and profits in order to justify continued operations, these relations change with abnormal rapidity. It is therefore difficult or even impossible for management executives to plan operations very far in advance and to give them any degree of stability of reasonably long-term nature.

In the rubber goods manufacturing industry, sales for the first quarter of 1948 were only slightly less than for a comparable period in 1947; production was and still continues to be maintained at a high level, *but* inventories of finished goods in most cases are increasing daily even though the rate of this increase is not unusually high.

This situation, although unfavorable, might not have been cause for undue concern if two of the above-mentioned basic factors, costs (labor) and prices, had not moved higher again recently with the resultant effect of canceling the gain for each party concerned and probably even reducing profit margins.

Tires and wire and cable were the first products to require higher prices following the "third round" of wage increases, but higher prices for most other rubber goods seem inevitable.

Increased productivity and greater sales volume have been indicated as about the best means for compensating for the increase in unit costs due to increases in labor, transportation, and material costs. As far as increased productivity is concerned, however, if one observes the production operations in present-day rubber goods manufacturing plants, it is hard to see how any very large increase in manhour productivity can be achieved overnight by improvements in the efficiency of the men or the machines. Labor, in general, appears to be reasonably efficient, and the industry has been mechanized to such a degree that any further advances would seem to have to be of relatively small order.

Of course materials and processes are undergoing intensive and comprehensive research and development at all times, but here again it is necessary to take a realistic attitude. The development and large-scale production of synthetic rubber in this country during the war years was a modern miracle of science and engineering, yet the cooperative and accelerated efforts of our scientists and engineers did not produce a better or a cheaper raw material. GR-S is an adequate replacement for natural rubber for most uses, and its compounding and use have been developed to the extent that it is practically interchangeable with natural rubber, but unless the quality

and the price of the latter become increasingly unfavorable, GR-S cannot be considered as a means of reducing production costs appreciably in most cases. The latest developments in GR-S, that is, rubber polymerized at lower temperatures, give indication that the quality of this rubber will be further improved, but the price may be higher than for regular GR-S.

With regard to the possibility of greater sales volume as a means of maintaining or improving profit margins, it is again hard to see how the recent increases in the prices of tires and other rubber products, however necessary, can have anything but the opposite effect. This effect may not be immediately apparent because of the needs of the European Recovery and national defense programs, but if there is any reduction in these needs over the next several months, an increase in sales volume at higher prices may be difficult to attain. Already one company, the Pharis Tire & Rubber Co., has had to suspend operations indefinitely because of reduced sales volume and the impossibility of meeting higher labor costs.

The purpose of the foregoing is not to cry "wolf" prematurely, but rather to suggest to management and labor in the rubber and associated industries that these most recent wage and price increases should be the last to be made for a considerable period of time.

The future of the rubber industry as well as all industry in this country will be brighter if the objectives of both labor and management are in the direction of lower costs and lower prices instead of higher costs and higher prices, which have been the case in the most recent past. Industrial progress in the United States in the last several decades has resulted from giving more and more goods for less and less money, and it does not seem logical for the reverse to be able to contribute equally as well to continued industrial progress.

## Increased GR-S Use Necessary

ACCORDING to recent reports from Washington, the government's program of stockpiling natural rubber will proceed at a more rapid rate during the next several months. The program for stockpiling strategic materials has a 1948-1949 fiscal year appropriation of \$600,000,000, as compared with last year's appropriation of \$100,000,000 plus \$75,000,000 contract authorizations.

Admiral Brane, of the Army-Navy Munitions Board, in testifying before the House Committee on Appropriations in Charge of Deficiency Appropriations, has indicated that the Board feels that the rubber industry has now had nearly three years to find its supplies of natural rubber in the world markets and that the needs of national security must now be given first attention.

Industry plans for any further increased use of natural rubber should be reviewed in the light of the above facts, and increased amounts of GR-S substituted wherever possible.

# DEPARTMENT OF PLASTICS TECHNOLOGY

## Extrusion of Plastics<sup>1</sup>

C. P. Fortner<sup>2</sup>

**W**EBSTER defines extrusion as "to extrude: to force, press or push out." While extrusion of some plastics is a relatively new method of fabricating them, extrusion has been practiced for many years.

### History and Development of Extrusion

The first plastic, cellulose nitrate, was extruded, although in some companies like mine the terminology was not that of extrusion, but "hydraulic stuffing." Cellulose nitrate softened with solvent was charged in billet form into a cylinder and forced through a forming die by application of hydraulic pressure on a piston. My own introduction to extrusion was on an extruder operating much this same way except that we charged the cylinder with billets of cold lead and extruded lead wire. This method of using billets is obviously an intermittent process and one not adapted to heating quickly the material to be extruded, especially when the billet may be 18 inches in diameter and several feet in length. Some materials, of course, do not need application of outside heat to soften them for working, but most work more easily and more quickly if softened by heating.

Desirability of uninterrupted output and necessity of better heat control were at least two of the reasons for modifying the hydraulic extruder to a screw design. Much of the early work on use of screw extrusion was done with rubber as the extrusion material. Many of our plastics extrusion methods and much of our equipment are outgrowths of the rubber extrusion work.

Screw-type extrusion necessitated change in form of material to feed properly, change in barrel design, and development of drive equipment. Early extruders show that makers were limited, as were all other machinery makers of the time, by bearings, gears, and materials for barrel and screw. As improved materials have become available, they have been incorporated to make the extruder of today more capable of withstanding wear and corrosion of the screw and barrel and able to do a heavier and faster job with improved drive gears and thrust bearings.

The need for temperature control, either in heating the material to extruding temperatures or in removing frictional heat to keep the temperature below the decomposition level, led to jacketing the barrel and the use of a temperature control medium. Since temperatures at the time of the early work were low, it was natural that water and then steam should be used. The desirability of higher temperatures without the inconvenience of excessively high steam pressures led to the use of oil as a heat transfer medium. The necessity of tem-

peratures beyond the range of oil have led to the use of such mediums as Dowtherm and the direct application of heat by attaching electrical resistance heaters to the barrel or by inserting them in the screw. Fortunately most of the plastics which require high extrusion temperatures require constant addition of heat and develop little if any frictional heat; so the need of removing heat has not been great. In those cases where heat must be removed, but temperatures maintained at, say, 650° F., controlled amounts of compressed air or water may be fed to the jacket, and the resulting hot air or super-heated steam vented to the atmosphere. Development of control instruments has made possible the very accurate control of temperature needed for some materials.

Early work with the extrusion screw was done with the more simple type of screw having uniform pitch or lead and uniform depth of flight. As a result of this work, many types of flight cross-section are found. To obtain the desired feeding and reduce the backslip additional flights in part of the screw are sometimes used. Some screws are used in which the depth of flight is varied; others in which the pitch is varied. On others the shape of the cross-section of the flight is varied along the screw, and on still others a torpedo or spreader section is introduced. Combinations of any and all of these are sometimes used.

The closure of the cylinder end by means of a head or crosshead has also furnished fertile ground for inventive effort. There are as many types of head as there are machines, each with its own advantages. In general, shapes are extruded through the die almost as a continuation of the screw. Some coatings are made by passing the base material through a hollow screw and a guide tip, and hence the material straightens out, but most coatings are done by using a crosshead so that the base material enters and leaves at an angle (usually 90 degrees) to the screw.

After leaving the die, the extruded article must be suitably carried away. For some materials a simple conveyor will suffice; others require tension on the extrusion to obtain desired dimensions. This tension may be obtained by nip or pinch rolls; capstans, or other pulling media.

Just as temperature control is necessary throughout the extruder, control of cooling rate of the extruded piece after it leaves the extruder is usually vital. The choice of cooling means is governed by the material, cross-section, and rate, but usually a liquid or gas heat transfer agent with controlled temperature is used. Varied amounts of radiant or inductive heat are also sometimes used.

No one piece of equipment is suitable for all plastics; it may be best for one type and usable on other types. It would be desirable if all extrusion could be done on specialized equipment, with each machine handling only that plastic for which it is best suited. This aim, however, is

usually not economically feasible. The development of new materials as well as changing public fancy in extruded articles dictates that most machines be not too specialized. Availability of standardized equipment with consequent saving in delivery time and cost of special design and machine work is another factor.

The supplier of raw material for the extrusion should always be consulted relative to the ideal set-up for his material and for recommendations as to how far one may deviate from the ideal and still obtain the quality and production rate necessary for profitable operation.

### Extrusion of Acrylics

To discuss more specifically the extrusion of a given plastic, let us start with acrylics. Just that is not even specific enough; my own company currently supplies three types of extrudable acrylic powder, each with its own peculiarities, and there are, of course, competitive materials. We could pick one of these and discuss the ideal set-up for a particular size and shape, but such a discussion would be too specialized. We will therefore consider general conditions and extrusion technique for acrylics.

The barrel of the extruder should be short, and any extra sections on the barrel should be removed. The barrel should be of a type that may be heated to 450° F., although this temperature will vary with the particular acrylic powder, and the barrel should also have provisions for removing heat.

The most desirable screw has a uniform depth of flight and increasing pitch to give approximately a 2:1 compression ratio. It is undesirable to use a screw with a torpedo or spreader, and it is well to have a hollow or cored screw. During start-up the screw may be heated to reduce warm-up time, but a slight cooling is usually desirable during operation. A small amount of water controlled by a needle valve for exhaust temperature of 200-250° F., or bleeding a small amount of compressed air into the screw is usually adequate for cooling.

No breaker plate and no screen should be used. These develop weld lines which later become foci for formation of bubbles. The weld line may also weaken the product structurally. Where all other conditions are not ideal, it may become necessary to introduce a breaker plate to alleviate a twist in the extrusion which is imparted by the screw. In such a case the breaker plate should be so designed as to produce as few weld lines as possible and to minimize those produced. Good streamlining throughout is necessary since interruptions to smooth flow may form weld lines or optical distortions.

A long land is used to cause sufficient back pressure for good mixing and homogenizing. Length of land is, of course, a function of the cross-sectional area and shape and of the composition being run, but it is usually computed by the general rule that it be 10 times the diameter for rods over  $\frac{1}{2}$ -inch, five times the diameter for rods  $\frac{1}{2}$ - to  $\frac{1}{4}$  inch, and three times the

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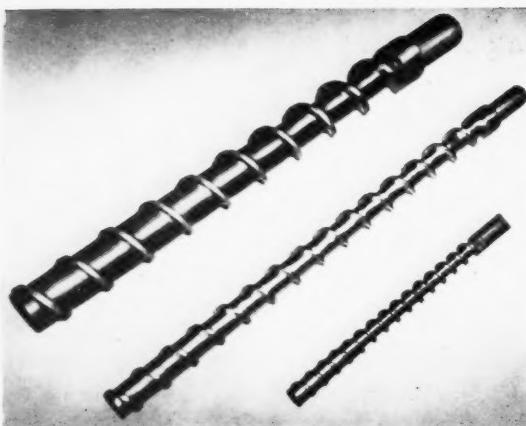


Fig. 1. Typical Screws for Extrusion of Nylon

diameter for rods less than  $\frac{1}{2}$ -inch. Tubing dies have lands based on wall thickness. Lands must be very well polished and have streamlined approaches.

The extruded article is about one-third smaller in cross-section than the die. Shapes other than round require compensation for the variation in flow. Flow of acrylics is very similar to the flow of viscous liquids, for which the center of a round cross-section will move at twice the mean rate. On other than round sections failure of the extruded shape to correspond to die shape indicates more rapid flow in the center and on flats as they approach the center. Of course, heating the die can to some extent offset the normal viscous flow by making the outer surface less viscous than the center, but viscous flow will still take place in the major part of the cross-section and must be compensated.

For pieces with a maximum solid section of less than  $\frac{1}{2}$ -inch it is possible to extrude on to rollers or a conveyor and cool in air. As this  $\frac{1}{2}$ -inch section size is approached, it will become increasingly difficult to cool the part without the formation of vacuum bubbles. While larger sections have been run with no special cooling control, there usually is enough waste in scrap and trial time to pay for suitable equipment to control cooling.

Acrylics shrink about 10% when cooling to room temperature from the plastic state. The rate of heat transfer is sufficiently low that the outside of an extruded rod may easily be cooled by room conditions to a solid, hard shell, while the center of the piece is still plastic and still at extrusion temperature. As this interior cools, it shrinks, and, if the outside is too cool and hard, shrinkage is evidenced by formation of the familiar vacuum bubbles. If a breaker plate has been used or if other equipment has caused weld lines (even though they may be invisible to the naked eye), these weaker points are the ones that give way first. Controlled rate of cooling makes possible extrusion of the larger section. Hot oil baths, steam coils, infrared lights, an adaptation of the muffle furnace, or even hot water may all be used to offset the effect of radiation on surface heat and promote uniformity of cooling.

These methods all entail handling the extruded material while it is in a plastic state, and suitable support must be provided to prevent distortion. Fluid baths simplify this requirement as only a portion of the weight of the extruded ma-

terial must be supported by rollers or conveyor. The length of this "controlled cooling" will naturally be affected by the maximum section and the rate of extrusion. It is to be expected, but some very competent people forget that a large machine with larger output than a small machine will require a longer cooler for the same section.

Another method used to prevent vacuum bubbles is that disclosed by the Plax Corp. and one on which it holds certain patents. In effect, the die is very long (many feet) and is progressively cooled. As the extruded material is enclosed in a die until cool, pressure is exerted on it at all times. As cooling occurs and shrinkage would tend to occur, more plastic may move into place under pressure in the viscous center. Back pressure, of course, would be excessive in a long die such as this and the material would freeze to the die, but lubricants may be introduced at proper points to allow slippage of the material past the die.

Before extruding acrylic powder it is necessary to remove the volatiles which would otherwise lead to bubbles or, in extreme cases, to even a frothy product. This drying may be done in a steam or electrically heated oven or under infrared lamps. The powder should be spread in trays less than  $1\frac{1}{2}$  inches deep and heated at  $180^{\circ}\text{ F}$ . for at least four hours. Attempts at faster drying usually result in caked material in which the surface has dried and caked, but the under part has the original volatiles entrapped by the surface cake.

It often saves much more in scrap and working time than the original cost if a hand pyrometer with needle couple is provided. When bubbles occur in the rod, they may be any of three types: vacuum, volatiles, or decomposition. All may overlap, but, in general, vacuum bubbles occur at some distance from the die. Volatiles and decomposition bubbles usually appear at the die, although volatiles bubbles may appear a few inches from the die. If the temperature of bubbled stock is taken with a needle pyrometer, an immediate indication may be had as to whether there is decomposition. This temperature must be determined at the center of the cross-section, and a needle type of couple is therefore necessary.

Heat of friction may raise the temperature of the stock in the barrel considerably above the temperatures of the die, screw, and barrel. In this connection it is inter-

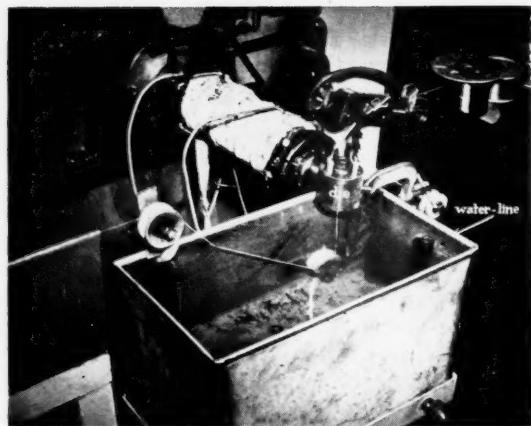


Fig. 2. Extrusion of Nylon Wire Insulation (Note Closeness of Water Bath to Die)

esting to note that on one occasion we tried cooling the screw and the barrel to reduce overheating due to excessive screw speed. We went to the extreme of running cold water in both screw and barrel with no reduction in the  $500^{\circ}\text{ F}$ . temperature of the bubbled stock; only a drop in production resulted. Only a drop in screw speed from the excessive 100 rpm rate resulted in the desired reduction in temperature.

#### Extrusion of Nylon

Nylon is one of the newer plastics and, while not so generally being extruded, is gaining in popularity. Here again it is necessary to discuss not just extrusion of nylon, but rather extrusion of each specific nylon. Since these materials and the techniques involved are not too well known, some discussion of the specific nylons and their extrusion will be applicable.

#### Nylon FM-10001

Although normally an injection material and often listed as not extrudable, nylon FM-10001 may be extruded, and this work is being done commercially by several custom extruders. This material is the horniest and hardest of the nylons in the cold state and is also the most fluid at extrusion temperatures. At this temperature of around  $525^{\circ}\text{ F}$ . the nylon is of approximately the viscosity of #20 motor oil. Obviously it will follow not the laws of viscous flow mentioned for acrylics, but the laws of fluid flow.

For a stock temperature of  $525^{\circ}\text{ F}$ . an ideal extruder is one with a very long barrel, the longer the better, and a temperature of  $550\text{--}575^{\circ}\text{ F}$ . Where a very long barrel cannot be had, a shorter barrel with relatively higher temperature,  $650\text{--}700^{\circ}\text{ F}$ . may be used, but there is probability of decomposition and resultant impairment of properties. These temperatures are in some cases obtainable with oil-heated barrels, but are usually impracticable with this method. Resistance electrically heated barrels are more desirable.

The most preferable screw is one with uniform pitch and decreasing depth. Where only a small part of the capacity of the machine will be utilized, it is necessary that the last three or four flights be of uniform depth and very shallow. Of course it is desirable to operate nearly at capacity most of the time, but for some coatings or small extrusions this variation in desirable screw has been developed. (See Figure 1.)

A breaker plate should be used together

with screens. We have tried many combinations and vary them somewhat, depending on the cross-section of the part being extruded. Our standard screen pack is now a 20-mesh supporting an 80, four 120's, another 80, and a final 20-mesh screen. Similar results may be obtained by using two 100- and two 150-mesh screens. It is also possible to substitute a 40- or 60-mesh screen for the 80-mesh as its main function is support and protection. If fewer screens are used, a uniform flow is not obtainable. The screens cause a build-up of back pressure which results in uniform flow and good mixing and homogenizing.

If the extruder is operated at a rate greater than its ability to transfer heat to the nylon, there will be unmelted particles carried forward to the screens. These will cause a dam and restrict flow until they soften. Extreme surging will become evident in this case, and such trouble is most likely to occur where the heating of the barrel is inadequate as the result of poor coefficient of heat transfer, short barrel, or heaters of low capacity. A deep screw also may cause surging of this type.

Since nylon FM-10001 is very fluid and does not decompose to any appreciable extent in the barrel when no air is present, there is very little need of streamlining if that would complicate the design of the crosshead or die, or increase their cost. Because of the fluidity of the nylon the length of land on the die is not of paramount importance. Normally a 1/16-inch land is used, although in some instances this is increased to 1/8-inch in order to make a fixture which will be more durable and less easily damaged by operators or by core materials being coated.

Extruded shapes of FM-10001 nylon have all been made by vertical extrusion with a crosshead so arranged that the die provides extrusion downward. The quench is cold water circulated to maintain uniform temperature. The quench tank must be so arranged that the water level may easily be changed. During start-up there must be room for the operator to thread the take-off. During this thread-up it is probable that a large piece will neck down greatly; in some cases from 1.5 inches down to 3/8-inch.

After such sheaves as are installed in the quench tank have been threaded and the take-off has been started, the water level is raised usually to a distance of 1/8-inch from the die, although in some cases 1/64-inch is more desirable. The object is to freeze the nylon before turbulent flow occurs and before surface tension deforms the shape or too great reduction in cross-section occurs. Obviously, good control of water level and turbidity is vital. If the water does touch the die, it will freeze the nylon to the die and necessitate lowering the water for rethreading as soon as the die returns to temperature (usually only a few seconds if the water level is dropped immediately).

It is essential that machine capacity be adequate to supply fluid nylon to the die at a rate high enough to keep it filled. There is practically no viscous point or temperature for this nylon, and an adequate supply of molten nylon must be maintained to keep low fluid pressure at the die orifice. Vertical extrusion of FM-10001 nylon tubing has not been successful because water pressure collapses the tube. Application of air to prevent this collapse usually results in blowouts at or above the water level as a result of the fluidity and lack of body at this point.

Tubing has been made by horizontal extrusion. Machine size and die design must

be such that under the fluid pressure it will look as though the nozzle effect of the die is causing the stream to squirt out about an inch. It is then possible to thread it through a water bath and take-up. The speed of the take-up will be fairly high, and the draw down from die size will be great; 1/4-inch tubing requires a 5/8-inch die. It is usually necessary to cascade the water from the water bath. Run the water through a pipe which is movable and can be slid toward the die so that the cascade will just miss the die. This adjustment obviously must be made after start-up. No air is needed to keep the tubing round.

In all cases of extrusion of FM-10001 nylon the material will be quite flexible after leaving the cooling bath and will remain so for an hour or two, after which stiffening will occur. If the extruded material is coiled or rolled up immediately, the stiffening will cause a set along the curvature of the coil or roll. Where straight lengths are required, they should be cut and stored straight for a short time.

#### Nylon FM-3001

Another nylon is FM-3001, which has been extruded more often than FM-10001. The techniques are very similar. At extrusion temperatures of about 450° F. the viscosity of FM-3001 is about that of #40 motor oil or of a good grade of strained honey. For this nylon, too, a long barrel with an adequate heat supply is necessary. Again the preferred screw has uniform pitch with decreasing depth. For this type of nylon a screen pack is also needed to achieve uniform flow. A suitable pack is made up of a 20, 60, four 120's, another 60, and a final 20-mesh screen. Shapes are extruded vertically with water level almost against the die, and tubing is extruded horizontally with no air introduced.

This FM-3001 nylon is the type most often used for wire insulation and as a protective coat for other insulations. It is also used for other coatings, such as on string, paper, etc. It lends itself well to very fast coating and to very thin coatings. Magnet wire of 34-36 gage has been coated with an 0.3-mil thick coating of FM-3001 at a rate of 1,000 feet a minute. When improved take-ups are installed, this thin coating is expected to be applied at better than 2,000 feet a minute.

In this method of wire coating a fixed-center die is used from which is extruded a tube of nylon having five to 10 times the ultimate wall thickness. This tube is pulled down in diameter and wall thickness by the high speed of travel of the wire as compared to the extrusion speed of the tube. To insure high bonding and better adhesion it is customary to use a vacuum attachment with a very slight vacuum to bring the nylon quickly into contact with the wire.

In case any drawing die lubricant has remained on the wire the vacuum tends to eliminate gas bubbles caused by volatilization of the lubricant. For best bonding it is necessary also that the wires be preheated. Cores other than wire should be relatively free from moisture, but string, rope, and paper have all been coated with no drying although they had been on hand for some time and the humidity was high. Rayon and even such material as lead wire have also been coated with FM-3001. The rate of coating is such that even materials of low melting point may be coated. They pass through the crosshead at such high speed that they are not overheated, and a fast quench in water cools the nylon before it can overheat the core material.

This coating may be done either vertically or horizontally. The vertical method with a water bath a few inches below the die is preferable, but for other than small wire or cores mechanical considerations make it more practicable to coat horizontally with the coated material entering a water cascade as near the die as practicable.

#### Other Nylons

Another nylon much used in extrusion wire coating is FM-3605. This material is less fluid at extrusion temperatures and is more flexible in the cold state than FM-10001 and FM-3001. FM-3605 can be extruded well in the manner used for these nylons, although being less fluid, it requires less fine screens and the water quench need not be quite so close. A deeper screw may also be used. The uniform-depth, variable-pitch screw works well with this composition although attempts at very high rates may carry unmelted material to the screen and cause surging.

Still more viscous nylons and relatively more flexible in the cold state are the M-6001 series. Either a uniform-depth, variable-pitch or uniform-pitch, decreasing-depth screw may be used for these nylons. For these also must be inserted a screen pack, but less fine screens are needed for the FM-3001 and FM-1000 types.

Extrusion temperatures for the FM-6001 nylons are within the range of oil-heated barrels, being extruded in the range of 450-500° F. The stock at extrusion temperature is rather viscous and has sufficient body to permit handling with more conventional take-off conveyors and cooling tanks. The slight modification of set-ups made for acetate rod, tube, or shape is suitable for the extrusion of this type of nylon.

To indicate that the nylons run the full gamut of extrusion conditions let us discuss one more. FM-8001 has been extruded most successfully when no heat has been added and slight amounts of frictional heat have been conducted away. In this case a short screw with full-depth flights has been desirable. Temperatures have been 250-300° F., and the cooling of extruded pieces has been done by air. No screens are used although a breaker plate is desirable. The land should be rather long, as least as far as nylon is concerned; about 1/4-inch for straps 1 1/2 by 1/16-inch in size.

This FM-8001 nylon after extrusion is like stiff leather; while at extrusion temperatures it is very doughy and rubbery. Slight variations in temperature will cause it to become crumbly through decomposition. It has been possible with this material to take a clean, cold machine and by starving the screw to start up and run at 250° F. with no external heat whatsoever. All heat in this case is frictional heat. FM-10001, at the opposite end of the nylon scale, generates no frictional heat. Obviously the power needed to drive the FM-8001 extruder is greater than that for the FM-10001 extruder.

For FM-8001 reasonably good, though not perfect, streamlining is desirable. This nylon decomposes much more readily than the other nylons mentioned, and dead spaces in the crosshead and die are therefore to be avoided.

#### Extrusion of Polythene

Polythene is a material for which a multitude of techniques is being developed. It lends itself to varied methods of handling much more than any other plastic and has a very wide band of temperatures over which it is extrudable.

Some extruders have run special shapes at 250° F., although the suggested optimum is 450° F. Many extruders operate at 500° or 550° F. although these temperatures approach that at which loss of properties will result. This point indicates a possible band of 300° in which extrusion might be carried out, but temperatures should not vary that much during extrusion. The temperature must be kept constant with good control instruments, but the point at which it must remain constant is not so critical as with most other plastics. A uniform-depth, variable-pitch screw is most desirable, but almost any standard screw will do a reasonably good job. A breaker plate and a screen pack of 20-, 60-, 120-, 60-, and 20-mesh screens should give good uniform flow. Streamlining of crosshead and die are not necessary, especially if extrusion is carried out at temperatures below 500° F.

Polythene lends itself well to making thin sheeting which is produced either as a thin flat sheet or as a thin-walled tube of large diameter. For the flat sheeting a manifold-type die is used feeding a slot over which jaws are fitted. These are made in a variety of lengths, such as 24, 36, and 52 inches. The sheet is extruded downward from the jaws which are set at about five times the thickness of the desired thin sheeting. Take-off rolls pull the sheet under a roll in a water quench bath directly under the die. The surface of the water is usually kept about five inches from the die. For best transparency a circulated hot water bath is used. Accurate zone heating across the width of the die is necessary.

In the case of flat sheeting the stock leaves the extruder in a much thicker section and is then pulled while still hot to the thin section. The thin-walled tubing is made by extruding a heavy-walled tube, and that in turn is blown while still hot to a diameter which will give the required thin sheeting. Careful control of the air pressure and take-off speed is vital for good control of thickness in both methods.

Length of die land has not been shown to be of great importance, although experience has indicated that 1/10-inch length for the flat sheet and 1/4-inch length for the thin-walled tube are best. For filaments a land length of 3/8-inch gave maximum smoothness and strength. Land lengths of 1/2- and 3/8-inch are satisfactory for extruded shapes.

Polythene is usually cooled by water, although air cooling is sufficient in some cases of small sections made at slow rates.

#### Summary and Conclusions

I have discussed only a few of the extrudable plastics, and these not in really great detail, but they illustrate the wide variety of conditions and problems which exist. Each material and many shapes for the same material offer new opportunity for development of new tricks in handling. Extrusion is an interesting business.

#### Lustrex, Lucite Price Changes

PRICE reductions for Lustrex, an improved polystyrene molding material, were announced on July 1 by James R. Turnbull, general manager of sales for the plastics division, Monsanto Chemical Co., Springfield, Mass. The price changes ranged from 2½¢ to 18¢ a pound, de-

pending on quantities, and were effective immediately. With the reduction the price of Lustrex in standard colors will range from 44¢ a pound in less than 100-pound lots to 35¢ a pound in carload quantities. Completion of major production units which make volume quantities available led to the reduction, Mr. Turnbull said.

On July 5 the plastics department, E. I. du Pont de Nemours & Co., Inc., Arlington, N. J., announced price increases for Lucite acrylic resin sheets and rods and a reduction in prices for certain sizes of nylon monofilaments, effective immediately. The Lucite price increases amounted to approximately 7% for sheets and 10% for rods. Reductions of about 25% in price were made for nylon monofilaments in pound tests of 30, 40, 50, and 60, which are used extensively in fishing lines.

#### New Vinyl Finish

VINYLUM #45, a new product specifically designed for the coloring of vinyl compounds with aluminum to produce metallic and iridescent effects, has been developed by Argus Chemical Laboratory, Inc., 56 Clifton Pl., Brooklyn 5, N. Y.

A blend of ultra-fine, polished aluminum powder and a special vinyl copolymer which contains a dispersing agent of unusual efficiency, the new product is said to eliminate differences in color intensity in metallic and iridescent vinyl compounds. The new material, it is claimed, has many advantages over the usual aluminum pastes, powders, and masterbatches. Being completely compatible with vinyl resins and plasticizers, it has no material effect on the processing characteristics or physical properties of the vinyl compound to which it is added.

The new product disperses easily and quickly in vinyl compounds and can be dispersed in one-quarter of the time needed for aluminum powders. Although it contains only 45% by weight of aluminum, the hiding power and metallic luster imparted by Vinylum #45 is much higher than that given by conventional powders and pastes. This characteristic is due primarily to the form in which the aluminum particles are dispersed in the blend and to the presence of the dispersing agent. Uniform concentration in the vinyl compound is readily obtainable, thus eliminating the color intensity differences commonly resulting from cut and feed marks. When dispersed in a vinyl compound, this new material produces a firmly held aluminum-vinyl mixture in which the aluminum will not streak, separate, or cluster regardless of "hank" or other variable calender conditions. Vinylum #45 is completely non-dusting and workable; there are no losses from adhesion to containers, spillage, or flying dust, and no contamination of plant equipment or other compounds.

#### Informative Labeling Program

RETAILERS, consumers, and industry members in the plastics field have met to inaugurate the informative labeling program being sponsored by the Society of the Plastics Industry, Inc., 295 Madison Ave., New York 17, N. Y. The program will be prepared by representatives of the plastics industry working in close coopera-

tion with the consumer relations committee of the National Retail Dry Goods Association, and the National Consumer-Retailer Council. In recent months new emphasis has been placed on informative labeling, and the plastics industry, through the SPI, is one of the larger industry groups actively to inaugurate this type of program.

The initial gathering was attended by representatives of companies concerned with all of the steps through which a plastics product may pass. At the meeting the steps to be taken in the program were arrived at by a composite of the points of view presented by those in attendance. Findings will be reported to the industry as a whole for such voluntary action as its members may see fit. In addition to some 32 company representatives at the meeting, Chairman Elmer French, general sales manager of Firestone Plastics Co., and Allan Brown, vice president of Bakelite Corp., represented the plastics industry; William T. Cruse, executive vice president of SPI, represented the Society; Harold W. Brightman, president of Lit Bros. and chairman of the consumer relations committee of NRDGA, spoke for the retailer; and Miss Ruth W. Ayres, managing director of National Consumer-Retailer Council, represented the consumer.

#### New Adhesive for Polystyrene

A NEW adhesive for bonding polystyrene to itself or to rubber, paper, cardboard, fabric, glass, and certain other plastics has been developed by the chemical division of Koppers Co., Inc., Pittsburgh 19, Pa. Designed to eliminate many of the shortcomings of previously obtainable adhesives for polystyrene, the new adhesive has the following claimed advantages: (1) Although it is a solvent for polystyrene, its solvent power is controlled so that etching, which weakens the plastic and mars its surfaces is minimized and molding stresses are relieved before they can cause cracks. (2) The adhesive has quick initial set although permanent set with maximum bond strength develops within a few days (assemblies may be removed from clamps in less than five minutes after the adhesive is applied.) (3) When the adhesive is properly applied, clear, bubble-free bonds of great strength are obtained. (4) In dry assembly it can be applied by brush, syringe, or dropper since it will flow between matching joint surfaces; and (5) it can be used for filling the gap between poorly matching joint surfaces by mixing two parts adhesive with not more than one part of polystyrene and using the mixture as a cement. The new adhesive is available in 55-gallon drums, five- and one-gallon cans, and in quart or pint glass bottles. Further information on properties, methods of applications, and results obtainable appear in the company's bulletins, C-8-121 and C-7-109.

#### Polystyrene Molding Discussed

A TALK on "Injection Molding and Mold Design," by Gordon B. Thayer, Dow Chemical Co., featured the June 25 meeting of the Buffalo Section, SPE. Mr. Thayer's talk dealt with polystyrene, (Continued on page 694)

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# Scientific and Technical Activities

## ASTM Committee D-11 Detroit Meeting

FIFTEEN subcommittee meetings and a meeting of the ASTM-SAE joint committee on automotive rubber preceded the meeting of Committee D-11 on Rubber, which was held in Detroit, Mich., June 23, 24, and 25, as a part of the annual meeting of the American Society for Testing Materials.

### First Luncheon

As a special feature of this meeting of Committee D-11, there was held for the first time a luncheon for the members on June 24. An attendance of 75 indicated the considerable interest in this type of event. Simon Collier, Johns-Manville Corp., chairman of D-11, presided and expressed his appreciation for the large number of members present at the luncheon. He thanked G. C. Maassen, R. T. Vanderbilt Co., and R. M. Howlett, Enjay Co., Inc., the committee for the luncheon, for the work in arranging for it.

Mr. Collier then mentioned an "episode" that had taken place since the last meeting of D-11 and introduced A. W. Carpenter, of The B. F. Goodrich Co. and secretary of D-11, and his bride of a few weeks, Mrs. Carpenter. He then called upon L. V. Cooper, Firestone Tire & Rubber Co., who discussed the change in the life of Arthur Carpenter which had just taken place and mentioned the many new problems he would have to face. As an indication of the desire of fellow members of D-11 to help, Mr. Cooper presented Mrs. Carpenter with a sack containing \$200 in silver dollars. Both Mr. and Mrs. Carpenter then expressed their appreciation to the members of the committee.

### Committee D-11 Meeting

At the meeting of the full committee held on Friday morning, June 25, the minutes of the last meeting were read by Mr. Carpenter and accepted by the members. It might be mentioned that the committee, at the previous meeting, had voted to create a class of membership to be designated as honorary which would be conferred, upon recommendation and approval, on members who had rendered distinguished service in the work of the committee and who, by reason of retirement or other causes, could no longer continue as active members. It was unanimously voted that A. H. Flower, W. L. Sturtevant, H. S. Vassar, and P. L. Wormeley be made honorary members of Committee D-11.

It was also voted to continue as a regu-

lar part of D-11 meetings the luncheon for the members held for the first time on June 24. Messrs. Maassen and Howlett are to continue on the committee in charge of arrangements for the luncheon at the next meeting, but are to have also as members of this committee J. Breckley, Titanium Pigment Corp., and T. A. Builfiant, Barrett Division, Allied Chemical & Dye Corp.

It was reported that the chairman of subcommittee 2 on belting, 11 on chemical analysis, and 26 on processing, C. H. Ziemie (Republic Rubber Co.), Mr. Collier, and V. L. Smithers (Smithers Laboratories), respectively, had resigned. W. P. Tyler, of Goodrich, was appointed chairman of subcommittee 11, but new chairmen for the other two subcommittees have not been chosen as yet.

A new subcommittee on the use of mathematical statistics was approved. The purpose of this new subcommittee will be to aid the other subcommittees of D-11 in the evaluation of test results accumulated in the course of their methods and specifications formulation.

Members of D-11 will be circularized for their opinion with regard to holding a meeting of the committee in connection with a meeting of the parent Society scheduled for San Francisco, Calif., in October, 1949.

Some of the major points of the reports of the subcommittee chairman, as given at the meeting of the full committee, are listed below.

SUB. 3—THREAD RUBBER—J. J. Allen, Firestone. Results of tests for size, modulus, and permanent set, as made since the last meeting by producer laboratories with object of standardizing methods of tests, were considered. Samples of cut and extruded thread were used. Measurement of size by the weight method gave best agreement between laboratories. Differences in modulus values due to differences in methods and machines used became evident. Similar erratic results were found when permanent set values were examined. Further round-robin testing is to be conducted to decide on tentative methods of test.

SUB. 4.—ELECTRIC SAFETY EQUIPMENT—Gordon Thompson, Electrical Testing Laboratories, Inc. It was stated that standards for rubber electrical safety equipment had been formulated by the medical departments of the Armed Services during the war, following a questionnaire to 400 users and that the ASA committee,

of which Mr. Thompson was also chairman, had approved these specifications. The ASA standards for hose, boots, and shoes are to be recommended as tentative ASTM standards, and a letter ballot will be circulated to obtain a decision on this proposal. Standards for blankets and gloves are being developed.

SUB. 5.—WIRE & CABLE—J. T. Blake, Simplex Wire & Cable Co. It was recommended that tentative standards D 532-46T, Spec. for Rubber Sheath Compound for Electrical Insulated Cords and Cables, and D 574-46T, Spec. for Insulated Wire and Cable; Ozone-Resistant Type Insulation be adopted as standards. The change recommended in D 27-46T, Spec. for Insulated Wire and Cable; Class A0, 30% Hercu Rubber Compound, because of some negative votes during letter balloting, was withdrawn by the subcommittee chairman. Tentative specifications for thermoplastic vinyl polymer sheaths for electrical insulated cords and cables were not received in time for approval. Projects to determine the proper method for testing polyethylene cable, ozone resistance, tear tests on jackets, etc., are under way.

SUB. 6.—PACKINGS—F. C. Thorn, Garlock Packing Co. It was reported that the new specification for determining the compressibility of compressed asbestos sheet packing, after oil immersions, as adopted by ASTM-SAE Technical Committee A, would be added to D 733-46. The chairman reported the results of tests made to determine stress relaxation in rubber gaskets. Subcommittee members will be asked for their comments on that part of the proposed ZZ-R-601 Federal Specification on the chemical analysis of packing.

SUB. 7.—RUBBER LATICES—G. H. Barnes, Goodyear Tire & Rubber Co. The tentative specifications for creamed and centrifuged rubber latices have been approved by the subcommittee except for the specification for maximum and minimum total solids for creamed latices. It was requested that D-11 approve and publish these specifications, contingent on final agreement of the creamed latex total solids specification within the next few weeks.

SUB. 10.—PHYSICAL TESTING—L. V. Cooper. The Federal Specification Board recommendation of  $73.5 \pm 2^\circ$  F. and 50% relative humidity was approved by 86 members of D-11, opposed by 64; while nine members did not vote. As a compromise, subcommittee 10 suggests that instead of adopting the Federal Specification Board recommendation, ASTM require that the temperature and relative humidity be reported with all physical tests and



Committee D-11 Luncheon, Hotel Statler, Detroit, Mich., June 24, 1948

that in cases of dispute the federal specifications be used.

The revision of D 15-41, Methods of Sample Preparation for Physical Testing of Rubber Products, and D 412-41, Methods of Tension Testing of Vulcanized Rubber, were reviewed and will be circulated within the subcommittee for the purpose of preparing these revisions for recommendation to D-11 at the next meeting.

A report on the section which had been given the task of reviewing the literature and formulating a program for standard methods for determining the coefficient of friction was received. The objective of the section was defined, and the three basic principles for the operation of friction measuring devices were stated. The section plans to try to adapt one of the numerous commercially available instruments for standardized measurement of the coefficient of friction although none is considered ideally suited for this purpose. The design and the construction of a new machine are not considered possible as a project of the subcommittee or D-11 as a whole.

SUB. 11.—CHEMICAL ANALYSIS—W. P. Tyler. No official meeting of this subcommittee was held, but the new chairman reported progress on the work for the revision of Federal Specification ZZ-R-601. A compromise on the method for the determination of sulfur between the existing federal and ASTM specifications was being prepared. Work on methods for the determination of synthetic rubbers, and copper and manganese in rubber is being continued.

SUB. 14.—ABRASION TESTS—R. H. Taylor, National Bureau of Standards. The revision of D 624-44, Method of Test for Tear Resistance of Vulcanized Rubber, is still being studied. A report of a method for determining the deviations of the profile of the edge of died-out test specimens from a straight-edge perpendicular to the face of the specimen, as submitted to the subcommittee at the March meeting, is being prepared for publication.

The work on the correlation of laboratory and road abrasion tests on tires is being continued.

SUB. 15.—LIFE TESTS—G. C. Maassen. The section on the aging of vinyl compounds submitted a report summarizing the conditions for aging such compounds with special reference to their use in wire and cable insulation. The necessity of aging vinyl compounds in products other than wire and cable was discussed, as was the necessity of including light aging tests in the program. The report is to be circulated among the subcommittee members for criticism and comment.

The section on air oven aging stated that not all the results of the test program have been assembled as yet, but it expects to present most of the data at the ASTM meeting in November and to have a final report in March, 1949.

The section on GR-S aging suggested that D-11 schedule a symposium on this subject at the next ASTM meeting since time did not permit holding such a symposium at the June meeting in Detroit. The paper on the review of the literature of aging GR-S presented by the section at the March meeting was published in the June issue of India RUBBER WORLD (page 365).

The section on the effect of life aging on rubber and rubber-like materials stated that this work, which is of long-term nature, is being continued.

The section on ozone aging and its relation to sunlight aging has assembled

equipment for round-robin tests and is familiarizing itself with this equipment.

The specification, D 572-42, Method of Test for Accelerated Aging of Vulcanized Rubber by the Oxygen-Pressure Method, was criticized as not being in accordance with present practice because equipment, as currently being sold for this purpose and more particularly for air pressure aging, does not permit the specified procedure for temperature measurement to be followed. A new section was appointed to reword the specification so that proper methods will be indicated.

SUB. 17.—HARDNESS, SET AND CREEP—S. R. Doner, Manhattan Rubber Division, Raybestos-Manhattan, Inc. The section investigating the correlation of compression set tests made on plied-up samples, as compared with solid samples, reported that satisfactory agreement was obtained between the two types of samples and that, therefore, the plied-up samples could be used.

The section on factors affecting the calibration of the Shore A and Rex rubber hardness gages, which had submitted a report on this subject at the March meeting, could not make recommendations for adopting any of the conclusions of this report since agreement in the subcommittee was not unanimous. A letter ballot will be conducted to determine whether revisions should be made of D 676-47T, Method of Test for Indentation of Rubber by Means of a Durometer.

SUB. 18.—FLEXING TESTS—B. S. Garvey, Jr., Sharples Chemicals, Inc. This subcommittee, recently reorganized, is reviewing existing specifications, such as D 430-40, Methods of Dynamic Testing for Ply Separation and Cracking of Rubber Products; D 623-41T, Methods of Test for Compression Fatigue of Vulcanized Rubber or Synthetic Elastomers to Crack Growth. With regard to the use of the Scott machine in D 430, editorial changes in the existing specifications were suggested; for the DeMatta and du Pont machines a revision of the specifications was considered necessary; and a specification for the use of the Ross machine is to be proposed.

SUB. 20.—ADHESION TESTS—L. E. Cheyne, Battelle Memorial Institute. Mention was made of the changes in status of D 429-47T in that it had been reverted to a tentative standard and of the inclusion of a section entitled "Adhesion Terminology." The problem of measuring adhesion in shear was discussed, and a program of study considered. An investigation of tackiness is also to be part of the work of this subcommittee.

SUB. 23.—HARD RUBBER—H. J. Flikkie, Goodrich. That part of Federal Specification ZZ-R-601 dealing with hard rubber products was discussed, and comments were submitted. A new method for testing asphalt battery containers was accepted.

SUB. 24.—COATED FABRICS—S. H. Tinsley, Vanderbilt. The section on abrasion tests submitted its report, and it was decided that a combination of two end points should be used in this type of testing. A machine of the American Sheet Co. was exhibited, and a series of round-robin tests with this Agewear machine is to be run.

Results with the du Pont scrub testing machine are not satisfactory. Changes in the machine are considered necessary.

A series of tests on thin sheeting samples is to be run.

SUB. 25.—LOW TEMPERATURE TESTS—R. S. Havenhill, St. Joseph Lead Co. The section on low-temperature dynamic tests

reported on additions to be made to the proposed specification using the Yerzley oscilloscope in order to cover low-temperature operation. It was voted to add additional paragraphs to D 945-48T to accomplish this purpose and to submit these additions to D-11 for letter ballot.

The section on forced vibration reported a lack of agreement on the results of the forced vibration tests, and these tests will be repeated. A Hevea tread stock will be run first at temperatures ranging from 0 to 122° F., using the U. S. Rubber, Goodyear, and Firestone forced vibration machines.

No further changes or recommendations for advancement to a tentative standard for the use of the Gehman low-temperature stiffness tester are to be considered until Sub. 27 (Mr. Kimmich) obtains cross-checks on the new improved Gehman testers manufactured by the American Instrument Co. Cross-checks with the Clash-Berg torsion tester being sponsored by Committee D-20 are to be made. R. C. Boyd, of D-20, has been appointed to serve on D-11 to help correlate the activities of these committees on low-temperature torsion testing.

Further improvements to the Gehman machine were discussed, and these will be studied by Mr. Kimmich's subcommittee, which will make final recommendations.

SUB. 27.—RESILIENCE TESTS—E. G. Kimmich, Goodyear. The test method for impact resilience and penetration of rubber by the Goodyear-Healy rebound pendulum, as presented at the March meeting, was recommended for adoption as tentative standard after the results of a letter ballot are obtained.

The results of the inter-laboratory test for resilience using the Yerzley oscilloscope, the Goodyear-Healy pendulum, and the Gehman forced vibration machine and for dynamic moduli using the Firestone, U. S. Rubber, and Goodyear methods, were examined and found to be in only fair agreement with each other. Further tests are scheduled.

SAE-ASTM TECHNICAL COMMITTEE A—J. L. McCloud, Ford Motor Co. Correlation of the results of the dynamic testing of rubber being carried on with ASTM subcommittees 25 and 27, is continuing.

The new tables of compounds for automotive rubber, the RS and RN series, are not quite ready as yet.

New information on conductive rubber has made necessary the establishment of new specification for this material.

Work is in progress on correlating weathering with ozone aging and high-temperature oven aging with life tests.

New V-belt and gasket specifications were submitted.

Standard samples covering 15 compound formulae have been tested by five cooperating laboratories, and although the results have not been completely analyzed, a preliminary examination indicates good agreement.

**The Aluminum Flake Co.**, Akron, has appointed Rice & Co., 23970 Effingham, Euclid, O., representative for the sale of aluminum flake in northern Ohio. This product is hydrated aluminum silicate, used as a rubber reinforcing agent. Berlow & Schlosser Co., Providence, R. I., represents the Aluminum company in the New England states and carries a warehouse stock. Standard Chemical Co. Ltd., Toronto, is Canadian representative and has warehouse stock at both Toronto and Montreal.

## The Second London Rubber Technology Conference

THE 1948 Rubber Technology Conference held in London, England, at Central Hall Westminster, June 23, 24, and 25, under the sponsorship of the Institution of the Rubber Industry, brought together more than 550 representatives from 23 different countries. Great Britain, of course, led the list with about 430 registrations; while the United States, Holland, and France each had about 20.

Eleven of the 42 papers on the program were presented by authors from the United States; these papers were concentrated mostly in the sessions dealing with synthetic rubber and carbon black.

The honorary president of the Conference was Sir Robert Robinson, president of the Royal Society and professor of organic chemistry at Cambridge University.

At the formal opening of the Conference on June 23, F. D. Ascoli, IRI president, presided and introduced Sir Robert. Mr. Ascoli took the opportunity of welcoming the representatives from the various countries and most particularly those from overseas.

Sir Robert, in his remarks, noted that there were few references in the program to the botanical and agricultural side of the industry and pointed out that the rubber plantation industry owed its whole existence to the activities of a small group of botanists. He referred, in particular, to the achievement of Sir Henry Wickham in 1876 in procuring supplies of rubber seeds and to the pioneer work on rubber cultivation begun by Henry Nicholas Ridley in the Straits Settlements in 1889.

He went on to say that there was nothing quite like rubber although, actually there was really no pure "rubber" in use at all. With regard to the development of synthetic rubbers, that task was as yet unfinished, but enough had been achieved to demonstrate the future possibilities.

Recent discoveries have greatly added to our knowledge of the mechanism of polymerization, and organic chemistry and chemical engineering are an essential part of the work of the rubber industry, as is colloid chemistry and scientific design, Sir Robert stated.

During the conference two dinners and two luncheons were scheduled. A luncheon was held at Central Hall for members on June 23. An invitation dinner was given by Imperial Chemical Industries, Ltd., the same evening at the Park Lane Hotel.

On June 24 an invitation luncheon was sponsored by the Research Association of British Rubber Manufacturers and the British Rubber Producers' Research Association at the Trocadero, Piccadilly.

The conference dinner and Colwyn Gold Medal presentation took place at Connaught Rooms, Great Queen St., the evening of June 24. The Medal was presented to R. P. Dinsmore, vice president of the Goodyear Tire & Rubber Co., Akron, O. The presentation was made by Mr. Ascoli, who reviewed the medalist's outstanding services to the rubber industry and in particular Dr. Dinsmore's work as assistant deputy rubber director of the wartime synthetic rubber program. In accepting the award Dr. Dinsmore said that his conscience was appeased by the knowledge that his name in the award was being coupled with the American industry's contribution to synthetic rubber development during the war. As the medium for that industry's recognition and in its name, he expressed gratitude for the Medal. Dr. Dinsmore, who is the sixteenth recip-

ient of the Medal and the first American to receive this distinction, has been a Fellow of the Institution for many years.

The delegation from the United States included: S. L. Bass, H. G. Bimmerman, L. H. Cohan, H. J. Cramer, D. F. Cranor, J. M. Davies, Dr. Dinsmore, D. Chase, P. Ottenhof, P. P. Pinto, G. Reinsmith, W. F. Russell, W. R. Smith, C. A. Stokes, B. M. Vanderbilt, A. J. Warner, L. A. Wood, P. W. Litchfield, I. Drogin, H. W. Grote, and D. L. Worl.

The programs and abstracts of the papers presented are given below. On the afternoon of June 24 an open discussion of tensile, hardness, abrasion, and tear testing of vulcanized rubber was held. This discussion was organized because of the meeting on June 28 and 29 of Technical Committee 45 (Rubber) of the International Organization for Standardization, which considered international standardization of the four tests mentioned. Mr. Bimmerman represented ASTM Committee D-11 on Rubber at this I.S.O. meeting.

### Abstracts of Papers

#### FIRST SESSION—JUNE 23—SYNTHETIC RUBBERS

Chairman, W. J. S. Naunton  
Deputy-Chairman, J. T. Watts

**Silicone Rubber**—A New Synthetic Elastomer. From the chemistry of silicone rubber it is seen that the inert characteristics of this material are due largely to the strength of the chemical bonds. The basic chemical structure of silicone rubber is a silicon to oxygen linkage that has a bond strength  $1\frac{1}{2}$  times as great as the carbon to carbon linkage of organic rubber. This together with the lack of unsaturation in the polymer makes possible in silicone rubber a resilient material that stays elastic from  $-70$  to  $500^{\circ}\text{F}$ . is resistant to weather, chemicals, and oils, and has good dielectric properties.

The physical properties of the silicone rubber measured at room temperature are lower than those of organic rubber. However, at extreme temperatures or under other difficult conditions where organic rubbers fail, silicone rubber remains relatively unaffected.

Processing is easily accomplished with standard rubber working equipment. Fabrication of the silicone rubber pastes is simplified because no solvent dilution is necessary. Molding cycles for the silicone rubber stocks are rapid; so a maximum use is made of expensive molds and presses. For small parts a cycle of five minutes or less is possible.

Many new uses for silicone rubbers are in the design or development stage. The full usefulness of silicone rubber is limited only by the resourcefulness employed in using this new heat-stable elastic material.

Many other problems have been solved with silicone rubber. A woven wire belt of steel was coated with silicone rubber. This belt is used in a food dehydrator designed for operation in circulating air at  $450^{\circ}\text{F}$ . The coating gives a smooth surface to which food does not adhere; yet the coating imparts no taste or odor to the food. Shafer L. Bass, Dow Corning Corp., Midland, Mich.

**Comparisons of Natural and Butadiene-Styrene Rubbers.** GR-S has improved in quality and uniformity since it was introduced, and experience has enabled us to make high-quality products with it. The paper covers only general-purpose

GR-S of a fixed monomer ratio, although there are a number of such rubbers. Originally less efficient to process than natural rubber, GR-S now is usually more efficient. Mixed blacks and latex masterbatches are important processing aids.

The rate of vulcanization of GR-S is seriously affected by high sulfur and high mercaptobenzothiazole. Careful compounding is necessary to obtain proper balance between strength, flex-life, and resilience. Likewise, for best aging properties, lower sulfur and Captax are indicated than would normally be used for rubber.

GR-S requires reinforcement with fine pigments for most purposes; otherwise it has little strength. Even so, it suffers from heat shortening at elevated temperatures; whereas natural rubber does not. Flex cracking develops more slowly, but spreads more rapidly in GR-S than in natural rubber. Contrary to its effect on natural rubber, flex cracking is less when GR-S is repeatedly flexed from zero elongation. Furnace blacks and clays retard crack growth with GR-S.

Resilience of GR-S is less than for natural rubber and, with vulcanization or aging, usually increases at the expense of flex-life. The German Buna S-3 gave high resilience, good wear, but poor processing. HMF blacks give good processing, improved resilience, and moderate wear reduction.

Tire data show only 10% increase in rolling resistance where 43% of the rubber hydrocarbon is GR-S.

Improved rubbers are possible, and the most promising improvement comes from lower temperature of reaction, lower polymer conversion, and higher viscosity.

This paper presents brief but cogent evidence that rubber technologists have produced products of unexpected quality from a somewhat inferior raw material. Improvement of the polymer and continued advances in the compounding art may threaten the supremacy of plantation rubber, unless the latter's potential production cost advantages are consistently developed. R. P. Dinsmore and J. H. Fielding, Goodyear.

**The Low-Temperature Performance of Butyl Inner Tubes.** Standard Butyl inner tubes in passenger-car service, when operated at temperatures below  $0^{\circ}\text{F}$ . for continued periods, develop buckles which may eventually cause chafing failures. This effect is believed due to increase in the viscous modulus compared with the elastic modulus of Butyl at low temperatures. The effect on performance of such factors as tire pressure, casing composition, and acceleration have been investigated; improved formulations consisting of highly plasticized, high molecular weight Butyl have been studied, and correlations established between tube performance and physical characteristics such as rebound, rate of retraction, modulus function, and oil viscosity. While commercial evaluation of such formulations is proceeding, other approaches are being studied by Canadian and United States groups, particularly involving polymers which may be brought to a more complete state of vulcanization.

The cooperation between the Canadian rubber industry and the Standard Oil Development Co. and Polymer Corp. on the development of Butyl inner tubes for low-temperature service was extended in 1947 by several companies to large-scale production of passenger-car tubes using plasticized GR-I R-13 formulations. Many of

these went into service in Canada during the exceptionally severe winter of 1947-48. A complete evaluation of their performance cannot be made, however, until the winter of 1948-49 after exposure to summer driving conditions.

Pending evaluation of the performance of the plasticized R-13 type of tubes in actual service, a comprehensive program is being carried out by Polymer and Standard Oil Development as follows:

1. Modification of Butyl to improve intrinsic low-temperature performance.
2. Achievement of a higher degree of vulcanization by use of more unsaturated polymer, higher vulcanizing temperature, alternative vulcanization procedures.
3. Compounding studies on plasticizers, blacks, and pigment dispersion.
4. Modification of tube design to equalize stresses.

5. Variations in tube mounting procedure including internal lubricants, casing treatment, and effect of air pressure. R. J. Adams, E. J. Buckler, and G. G. Wanless, Polymer Corp., Ltd., Sarnia, Ont., Canada.

**Preparation and Properties of Buna N Type Copolymers.** Buna N, a rubbery copolymer of butadiene and acrylonitrile, was developed by the I. G. Farbenindustrie in the late 1920's. Importation to the United States began in 1937, and the use of Buna N in this country reached a volume of 150 tons in 1939. Of the various grades of Perbunan (Buna N type) marketed by the Enjay Co., an affiliate of Standard Oil Co. (N. J.), that containing 26% to 28% of combined acrylonitrile has received widest acceptance.

In the synthesis of Perbunan by a typical emulsion polymerization, 0.5- to 0.75-part of aliphatic mercaptan per 100 parts of monomers is used to control molecular weight. A mixture of mercaptans in the C<sub>12</sub> to C<sub>16</sub> range has been found preferable to the use of any single mercaptan. The molecular weight of the mercaptan is much more critical in a neutral or alkaline emulsion system as compared to one of 2 to 4 pH. Addition of the mercaptan modifier portionwise during the polymerization process results in better utilization of the mercaptan and a copolymer of better physical properties than is obtained when all the mercaptan is added in the initial feed.

Recent investigation of polymeric-type plasticizers of the immiscible type for Buna N has resulted in "pure gum" and loaded compounds of excellent processing properties. Polyisobutylene of 12,000 molecular weight (Staudinger) used in proportion of 10 to 20 parts with 100 parts of Perbunan-26 of 95 Mooney is a typical example. Physical properties of vulcanizates obtained from such blends are in general comparable to those obtained when miscible ester plasticizers are used. The polymeric plasticizers are not extracted by oils. To get solvent resistance comparable to that of a non-plasticized stock, the nitrile content of the Buna N-polymeric plasticizer blend must be equal to that of a Buna N used singly.

Buna N is finding increasing usage in resins such as polyvinyl chloride and the phenolics. Such blends are of interest both as uncured and as cured stocks. In general, curing results in better physical properties and improved heat and light aging.

In conclusion it should be pointed out that Buna N is definitely a specialty rubber and owing to its relatively high price is finding use only where the cheaper and more processable all-hydrocarbon rubbers

(both natural and synthetic) are unsuited. Whereas Buna N type rubber previously found applications only in oil-resistant applications, its solubility in certain of the polar-type resins opens new applications as plasticizers for such materials. Industry is now making available Buna N types of lower molecular weight which are more processable than the older grades. This point and the development of new and better plasticizers place more and more emphasis on relative costs as the major controlling factor in the sales volume of Buna N. The cost of acrylonitrile and the relative volumes of production are the only factors of significance which attribute to the higher cost of Buna N as compared to Buna S. As this differential in cost is decreased the uses of Buna N will increase. There is a large number of mechanical rubber goods where marginal oil resistance is desirable if it can be obtained at a reasonable price differential. For such increased usage in the oil-resistant field Buna N will, of course, be in competition with other oil-resistant rubbers such as neoprene and "Thiokol." J. F. Nelson and B. M. Vanderbilt, Standard Oil Development Co., Linden, N. J.

**Some New Compositions Based on Condensation Rubbers.** By the condensation of a dibasic acid and di-reactive alcohol or amine, linear polymers are produced. Under certain conditions rubber polymers are obtained, and a number of "condensation rubbers" with outstanding physical properties have been described. One of these, a di-isocyanate modified polyesteramide (Vulcaprene A), has been found compatible with nitrocellulose, polyvinyl formal, cellulose acetate, degraded vegetable tanned leather, gelatine, and glue. These mixtures can be vulcanized by the formaldehyde-liberating agents used to cure Vulcaprene, and in most cases the curing reaction appears to take place not only with the Vulcaprene, but with other high polymers.

The combination of Vulcaprene and cellulose acetate, and Vulcaprene and degraded leather are of great interest to the leathercloth industry as they can be spread to cloth to give coatings with outstanding flex and abrasion resistance.

The Vulcaprene/cellulose acetate mixture is of value also as an abrasion and flex-resisting coating for rubberproofings to give products which, while cheap to produce, are likely to give superior service to pre-war leathercloths. This type of coating can be applied also to paper.

The di-isocyanate modified polyesteramide behaves not only as a novel vulcanizable polymeric plasticizer, but, in combination with these high polymers, gives new products of major interest to an important branch of the rubber industry. D. A. Harper, W. F. Smith, and H. G. White, Imperial Chemical Industries, Ltd., Manchester, England.

**Alteration of Neoprene by Polymerization Temperature.** Variation of the temperature at which 2-chloro-1, 3-butadiene (chloroprene) is polymerized, with other variables held constant, gives neoprenes with marked differences in the rate of crystallization and dispersion in solvents of the raw polymer and in the physical properties of the vulcanizates. For example, plastic polychloroprene formed at 10° C. quickly crystallizes, forms homogeneous solutions, and exhibits high tensile strength; whereas polymer produced at 100° C. fails to crystallize, swells only in solvents, and has low tensile strength. These changes in properties appear to be caused by alterations in the structure of

the polymer, notably the side-branching, cross-linking, spacing of the chlorine atoms, and possibly cis-trans-isomerism. The structural differences are small in magnitude and difficult to detect. Ozonolysis reveals that a soluble form of polychloroprene, as well as highly insoluble "popcorn" polymer, is at least 93 to 95% 1,4-addition product, and X-ray diffraction shows the polymer chains to have essentially a trans-configuration. Infrared spectroscopy indicates the absence of side vinyl groups. Branching and cross-linking will explain the decreased rate of crystallization and other properties of the less soluble polymers, and it is considered that varying minor portions of 4,1-1,4 or 1,4-4,1 addition or of intramolecular cis-isomers are a factor in the crystallization of the soluble polymers. Technical advantages of the variations in neoprene effected by polymerization temperatures are outlined. H. W. Walker and W. E. Mochel, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

#### SECOND SESSION — JUNE 23 — CHEMISTRY OF RUBBER

Chairman, S. S. Pickles

**Nature of the Sulfur Linkages in Rubber-Sulfur Vulcanizates.** Although the general nature of the reaction of sulfur with olefins leads to the expectation that in vulcanized rubber, sulfur is present in both intramolecular cyclic linkages and intermolecular cross-linkages, the precise point of attachment of the sulfur in the latter type of linkage has not so far been unambiguously demonstrated.

An extension of the reaction of sulfides with methyl iodide to cover the alkenyl-alkyl type of structure shows that trimethyl sulfonium iodide formation is not an exclusive characteristic of diallylic sulfides. It occurs with considerable facility with alkenyl-alkyl sulfides in which the sulfur atom joins an  $\alpha$ -methylenic carbon atom to a tertiary carbon atom, thus bringing into line the inferences obtained from studies of the reaction of methyl iodide with vulcanizates with recent work on the reaction of sulfur with polysoprenes. G. F. Bloomfield, British Rubber Producers' Research Association, Welwyn Garden City, England.

**The Hydrochlorination of Rubber in Latex.** A careful consideration of the influence of solvents on the hydrochlorination of rubber in solution has led to a fundamentally new technical process for the preparation of rubber hydrochloride.

If hydrogen chloride is passed through latex, stabilized with cationic (e.g., Fixanol) or non-ionic (e.g., Emulphor O) emulsifying agents, rubber hydrochloride is formed. The rate of reaction, slow at normal temperature and pressure, can be increased considerably by carrying out the reaction under pressure.

From the fact that rubber hydrochloride prepared from latex has a chlorine content quite near the theoretical value, it may be concluded that hydrochlorination of rubber in latex is not accompanied by cyclization. G. J. Van Veersen, Rubber Foundation, Delft, Netherlands.

**Some Observations on the Oxidation of Rubber in Light.** An apparatus is described for measuring the oxygen-absorption of vulcanized rubber, either in the dark or under illumination from a controlled light source. The light and dark oxidation curves of four vulcanizates at temperatures of 60, 65, and 70° C. are examined. Three of the four vulcanizates were protected by the incorporation of

spectively, of 2% phenyl- $\beta$ -naphthylamine, 2% mercapto-benzimidazole, and a mixture of 1% each of the above substances. The dark reaction over 60 hours' duration was in all cases similar and could be represented by a standard equation. It is shown that the effects of PBN and MBI on the dark oxidation are clearly different throughout the temperature ranges. From a consideration of the initial reaction the decay during storage of the initial oxidizability of the vulcanizates is shown.

In oxidation under light from a relatively weak source at a given temperature, the total absorption is considered as the sum of the dark thermal oxidation appropriate to the temperature, and a light-activated absorption. The effect of the light is then shown to be similar in all cases, the rate of absorption due to light starting from zero and increasing through a maximum to a constant value. By comparison of these constant light rates it is shown that PBN and MBI have little effect on the light-activated absorption of the control, but that the mixture (PBN, MBI) effectively reduces this absorption. The persistence or development of an enhanced dark rate after illumination is shown to depend upon the period of illumination and the length of dark storage of the vulcanizate. R. L. Stafford, I.C.I.

**Kinetic Analysis of Rubber Halides.** A correlation is established between the structure of an organic halide and its rate of reaction with a number of organic bases. Analysis by reaction kinetics, based on this correlation, is applied to the following problems: (1) estimation of the allylic fraction in the chlorination and bromination of natural rubber; (2) differentiation between a dichloride and a polychloride from natural rubber; (3) determination of an equilibrium between natural rubber and hydrochloric acid at 130° C. in closed systems; (4) identification of tertiary chlorides and bromides in natural rubber and allied polymers. G. Salomon, C. Koningsberger, A. J. Ultee, Rubber Foundation.

**The Direct Determination of Oxygen in Rubbers.** Application of the Unterzacher Method. The direct determination of oxygen in organic compounds by reduction with carbon on a micro-scale, by the Unterzacher method, is described, together with criteria of purity for the carbon and iodine pentoxide reagents employed. The method has been applied to rubbers, and a relative precision of 2% has been obtained, i.e.,

± 0.01 in the range 0 to 0.5% oxygen  
± 0.02 in the range 0.5 to 1.0% oxygen  
± 0.04 in the range 1.0 to 2.0% oxygen

For compounds containing larger amounts of oxygen the method gives an absolute accuracy of ± 0.2 or better. The method is speedier and yields more accurate results than when oxygen is determined by difference or by hydrogenation. A single determination requires but 30 minutes. W. T. Chambers, BPRRA.

**Kinetic Study of the Oxidation of Rubber. I.** Some Observations on the Case of Raw Rubber. Following a sketch of earlier work on the oxidation of raw rubber, an improved manometric apparatus is described and illustrated for determining the rate of absorption of oxygen by raw rubber. From fragmentary experiments it is shown to be very difficult or even impossible to obtain reproducible quantitative results. Storage of samples markedly modifies results, which are affected also by the partial pressure of the oxygen, the

rubber concentration and its previous history, and experimental conditions. The difference in behavior of antioxidants and oxygen deactivators toward raw rubber is clearly shown; the former have little effect; while the latter remain effective. J. Le Bras and A. Salvetti, Institut Français du Caoutchouc, Paris, France.

### THIRD SESSION—JUNE 24—PHYSICS OF RUBBER

Chairman, G. Gee

Deputy Chairman, L. R. G. Treloar

**Refractive Index of Natural Rubber for Different Wave Lengths.** The refractive indices of a prism of natural rubber have been measured at five different wavelengths in the visible region by the use of a spectrometer. Values of the rate of change of index with temperature at each wavelength have been computed for the range 19.5 to 39.3° C. The Eykman equation, in differential form, is used to calculate the expansivity from the index and its rate of change with temperature. It is concluded that the two-constant Cauchy and Sellmeier dispersion equations are inadequate to represent the data. The dispersion observed for rubber is found essentially the same as that of hydrocarbons of similar structure but of low molecular weight. L. A. Wood and L. W. Tilton, National Bureau of Standards, Washington, D. C.

**Some Applications of Elasticity Theory to Rubber Engineering.** Some of the implications of the classical elasticity theory of infinitesimal deformations and of the more general theory of the large elastic deformation of incompressible, isotropic materials in the engineering of vulcanized rubbers are discussed. It is not possible to deal exhaustively in a short paper with all the applications which can be envisaged. However a few of them are indicated to draw attention to the desirability of taking these theories into consideration in the design and testing of rubber components. In the paper, only the case of static deformations is considered.

The limitations of the classical theory are first discussed. The manner in which the elastic properties of the material can be described for all large deformations in terms of a stored-energy function is then described. The stress-strain relations, for a general stored-energy function, are given, and the stress components associated with a simple shear are calculated. The application of these results to the shear mounting are briefly discussed. The results of applied force-deformation calculations for an idealized torsional coupling are given. Finally some general implications of the theory of large elastic deformations with regard to the solution of problems, in which it is desired to calculate the deformation resulting from the application of given forces, are discussed. R. S. Rivlin, BPRRA.

**The Degree of Crystallization in Natural Rubber.** An improved X-ray technique has been worked out to determine the degree of crystallinity in natural rubber. Inaccuracies which sometimes occur in quantitative X-ray measurements were eliminated, and it has been shown that the amount of crystalline rubber both in frozen samples of raw rubber and in stretched vulcanized rubber could be determined fairly accurately. More experiments were carried out, and the results are described. These results, which confirm the current views on the problem of crystallization, point to relatively low degrees of crystallization, even in highly stretched rubber, and they agree with some other

experimental evidence and with a recent theoretical investigation.

In view of this encouraging agreement a combined investigation on a set of well-defined compounds, comprising crystallization (X-ray, density, optical), swelling, and mechanical measurements strongly recommends itself as a promising outline for future research. J. M. Goppel, Rubber Foundation.

### Permanent Set in Vulcanized Rubber.

The "permanent set" of loaded vulcanized rubber is shown to be almost entirely due to the way in which the filler particles are rearranged by stretching and is not a property of the rubber molecules. Treatment of these loaded rubbers in such a way as to enhance the orientation of the filler, for example, by heating the rubber to permit flocculation of the filler into agglomerates or chains and then cooling before stretching, or by stretching the rubber repeatedly, will increase the set. Conversely the set can be decreased by treating the rubber in a manner which enables or causes the "filler structure" producing set to disappear, for example, by heating the rubber after it has been stretched, by the incorporation of plasticizers, or by stretching the rubber at right angles to the extension used to produce the set.

Thus the so-called "permanent set" is not permanent at all and is not due to plastic flow of the rubber, as is frequently asserted, unless the rubber is grossly undrawn; in fact, the minimum set found with a range of cures on a loaded stock represents a point where the plastic flow has been reduced, but the "filler structure" caused by heating has not yet completely formed. The "final" value of the set in any experiment is an equilibrium point reached between the relatively weak intermolecular bonds which oppose recovery, on the one hand, and the thermal forces which tend to restore the original shape, on the other. This equilibrium can be altered by raising the temperature when the set assumes a smaller value. These considerations also account for a number of phenomena hitherto found perplexing.

It appears that normal set tests on loaded vulcanizates will not give a valuable indication of the flow behavior to be expected in service; for this purpose long-term set, creep, or stress relaxation tests are necessary. However, the set after extensions at high temperatures may be a useful accelerated test, as here the rate of the deteriorative chemical processes is increased, but, as in all accelerated tests which involve the interplay of a number of factors, the results must be used with caution. L. Mullins, Research Association of British Rubber Manufacturers, Croydon, England.

**Load Deflection Factors in the Design of Rubber Suspension Units.** One of the major difficulties in the mathematical design of rubber suspension units is the absence of proportionality between applied compressive stress and the resulting strain. It is, however, possible to simplify to some considerable extent the nature of the problems involved, by the use of the equation  $W = k(L - 1/L^2)$ . In this equation— $W$  is the load,  $L$  the extension ratio measured in the direction of the load and  $k$  a constant, identified by the statistical theory as the rigidity modulus.  $k$  can be determined by means of lubricated end compression tests on samples of any cross-sectional area. A

The actual value obtained for  $k$  from a series of tests depends to some extent upon the load history pattern used for the tests. In laboratory testing the choice

of pattern is limited either by the size of product to be tested or by the testing equipment to be employed. The constant rate of deformation pattern is used with most automatic testers. Results so obtained cannot safely be used to predict deflections produced by other forms of load history. To overcome this difficulty a new testing machine has been designed which enables any load history pattern to be used and which greatly facilitates the obtaining of long-term results.

In practical applications of rubber to engineering components the simple law  $W = kA(L - L^2)$  used for lubricated end compressions can be written in the more general form  $W = kf(x)$ , in which  $x$  is the deflection resulting from load  $W$ . In this form the term  $f(x)$  is a function of the deflection and includes factors for the size and shape of the component and for bonding or other constraints introduced into the system. It has been called the "Shape Function." The "Shape Function" for any product, in a compound for which  $k$  has been determined by a lubricated end compression test, can be obtained from a stiffness test on the product. H. L. Jenkins and D. H. D. Cooper, Dunlop Rubber Co., Ltd., Birmingham, England.

**Free Retraction of Elongated Rubbers.** The speed of retraction of the ends of elongated rubber rings relative to each other for a number of elastomers was measured at room temperature by a comparatively simple method. The results plotted as elongation *versus* time curves indicate that the mechanism of retraction is complicated and cannot be described by a simple mathematical equation. In the present case the so-called "permanent set" plays a part in the retraction velocity. A mathematical equation is given to account for this phenomenon. Elasticity is judged in terms of speed of retraction and "permanent set."

The speed of retraction does not give the same proportionate number between a "quick" and a sluggish material as does the impact resilience. The latter property shows more pronounced differences.

Most rubbers after retraction exhibit a considerable amount of "permanent" set. This set measured at a short time after free retraction is considered as an auxiliary value for judging the elasticity of a material. Expressed in terms of speed of retraction and short-time set the most-elastic "pure gum" compound measured was natural rubber, followed by Neoprene FR. Polymethyl pentadiene copolymer proved the last in the series. Of the carbon black mixes Neoprene FR proved more elastic than NR probably owing to a lower percentage of carbon black and the absence of Nurac (mineral rubber), of which the natural rubber compound contained about 10% B.B.S.T. Boonstra, Rubber Foundation.

**Experimental Methods in the Osmometry of Dilute Rubber Solutions.** A thermostated Fuoss-Mead osmometer for measuring the osmotic pressures of polymer solutions by the dynamic method is described. The technique of preparation of bacterial cellulose membranes for use with polymers of a wide range of molecular weights is given, and the precautions necessary for work in dilute solutions are illustrated. In particular, the dynamic method of Fuoss and Mead is reviewed in the light of results obtained using viscous rubber solutions. The construction of a modified, temperature-insensitive osmotic balance is described. H. W. Melville and C. R. Masson, University of Aberdeen.

#### FOURTH SESSION—JUNE 24—TESTING AND ANALYSIS

Chairman, J. R. Scott  
Deputy Chairman, R. G. Newton

**Tear Resistance of Vulcanized Rubber.** The method now used at the Rubber Research Institute T. N. O. (Delft) for the determination of the tear resistance of vulcanized rubber has been described in detail. The tearing test has been studied further. The influence of the thickness of the sample on the tear resistance has been investigated, and some experiments have been conducted to give an explanation of this influence. Further experiments indicate that at the moment of tearing an elongation is reached locally practically equal to the elongation at break of a standard tensile test.

Comparison of the angle tear test with the above method leads to the result that the Delft method is to be preferred. H. A. W. Nijveld, Rubber Research Institute T. N. O. Delft.

#### Tear Initiation and Tear Propagation.

Tear initiation and tear propagation are of equal importance to the rubber technologist, and both phenomena must be studied. The angle tear method gives a measure of tear initiation; whereas the crescent and I. G. tear methods are tear propagation methods. The angle method, therefore, should not be considered as an alternative to the crescent method. On grounds of reproducibility of test results, there is little to choose between these two, but experimental data show that the stress concentrations in the angle test-piece are too high with rubbers containing non-black fillers, and the method has practically no discriminating power with these compounds. The suggestion is made that the unnickled crescent test-piece should be used in preference to the angle test-piece for tear initiation measurements, and the nicked crescent used, as at present, for tear propagation measurements.

Tear tests have been classified as group (1) tests (direct tearing) and group (2) tests (tearing perpendicular to the direction of stretching), but it is now pointed out that the classification may alter during testing if knotty tearing occurs. The case where a knotty tear produced "fibering" in the test-piece is explained on the hypothesis that the cohesive forces between fibers reach a limiting value before the limiting value of the breaking strength of a fiber is reached.

Practical evidence of non-uniform stress distributions throughout the thickness of tear test-pieces has been found, and the existence of a maximum shear stress in sub-surface planes is illustrated. The experimental results suggest that, as the strength of the material is increased, so the effects of the maximum shear stress are reduced. Differences in the mechanism of tearing compounds containing different fillers (e.g., China clay, whiting, treated chalks, zinc oxide, and various grades of carbon blacks) have been noted. J. M. Buist, I.C.I.

**The Meaning of Test Results.** Most rubber technologists now realize that the "meaning" of a test result, in the sense of whether it is significantly different from a similar result or not, is best determined from the "errors" of test by the use of statistical methods, and this point has led to an interest in laboratory testing "errors." It is, however, not generally realized that the variation between results from different laboratories is often much larger than would be expected from the testing errors. Few test methods have been

examined for inter-laboratory variation, and large-scale cooperative programs are urgently required to show which tests are most subject to this trouble. An alternative, but less satisfactory, suggestion is to form a central "pool" of test specimens, thus enabling laboratories to carry out tests on material with known properties whenever they wish and thereby improve inter-laboratory standardization.

Another feature of the statistical treatment of data which is sometimes overlooked in considering the "meaning" of a test result is that a test method may have a small "error," yet be of little value because it is insensitive, having small power of discriminating between different materials; attention is drawn to examples of poor discrimination.

Laboratory tests have their fullest "meaning" when they correlate with the behavior of rubber in service. Hence the physical aspects of laboratory testing must be improved from two points of view: on the one hand, the standardizing procedures must be improved so that the excessive inter-laboratory variation is reduced, and, on the other hand, correlation with service behavior must be increased. Both these problems are discussed and suggestions are made for overcoming some of the difficulties. R. G. Newton, RABRM.

**The Interpretation of Plasticity Measurements.** After consideration of the various factors whose influence must be included in any complete assessment of the fundamental flow properties of uncompounded raw rubber, a comparison is made of results from various instruments. It is shown that a plot of  $\log(\text{shear stress})$  against  $\log(\text{strain rate})$  is substantially straight at low shear rates, but may be markedly convex to the log. stress axis at higher rates.

Reference is made to the limitations of the methods of Scott for the interpretation of the results of parallel-plate compression tests; attempts to apply the Nutting equation to the large strains in the usual compression tests with rubber are shown theoretically, and by experiments on materials of known characteristics, to be invalid.

Consideration of the instruments available for factory control purposes shows that the one figure obtained from conventional tests is inadequate for the evaluation of a new mix or even a new plasticizing or mixing technique, and alternative procedures are considered; for the control of nominally identical batches a single figure may be adequate.

Finally, the essential requirements for research and control instruments are compared, and available instruments in each group surveyed in the light of the earlier discussion. J. R. Scott and R. W. Whorlow, RABRM.

**A Tackmeter for Rubber Testing.** An apparatus has been developed which enables quantitative determinations of the relative tack values of various rubber compounds to be made, using either short-period cyclic loading or long-period loading of the contacting rubber surfaces. In the course of an investigation into the tackiness of GR-S compounds, Busse, Lambert, and Verdery<sup>1</sup> designed an apparatus which enabled the measurement of tack values to be put on to a quantitative basis, and the principles of the apparatus reported by them have been embodied into the tackmeter described in this paper. Examples are given of the operation of the instrument and of results with typical tire tread and extrusion compounds. E. W. J.

<sup>1</sup> *J. Applied Phys.*, 17, 376 (1946).

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Beaven, P. G. Croft-White, P. J. Garner, and G. Rooney, "Shell" Refining & Marketing Co., Ltd., Thornton Research Centre, Chester, England.

FIFTH SESSION—JUNE 24—NATURAL AND SYNTHETIC RUBBER LATICES  
Chairman, P. Schidowitz  
Deputy Chairman, S. D. Sutton

**The Mechanism of the Creaming of Latex.** The aggregation of rubber particles is a prerequisite for creaming, leading to an agglomeration of the small globules into clusters and by increasing their effective size, also their rate of upward movement through the serum. The theory that creaming involves the adsorption of the creaming agent on the rubber particles is considered incorrect; experimental evidence is given that adsorption leads to larger proportions of agent being required to effect creaming than when there is no adsorption. The preferred theory that creaming agents act by desolvating (i.e., dehydrating) the protein protective layer, thereby reducing repellent forces between the particles, is supported by other experiments. The late W. S. Davey and K. C. Sekar, Rubber Research Institute of Malaya, Kuala Lumpur, Malaya.

**Fresh Hevea Latex.** A Complex Colloidal System. Fresh *Hevea* latex is a complex system, containing two dispersed "phases": (1) rubber globules; (2) lutoids, i.e., small irregularly shaped, viscous colloidal bodies. The lutoids dissolve in ammonia and other alkalies, coagulate when the latex is diluted with water, but retain their form if the latex is diluted with salt solutions of certain concentrations.

By centrifuging, the lutoids are collected at the bottom of the tube as a separate layer with a sharp boundary. After separation, the fractions (now called the yellow and the white fractions) may be examined separately. From calculations based on the D.R.C., T.S., and other data of the yellow fraction, it appears that the lutoids consist for the greater part (80 to 85%) of water; whereas the dry material present consists of proteins, salts, and acetone solubles, etc., in the form of lipoids, and probably also sugars. This dry material represents 6% to 8% of the total solids of the latex.

The importance of the lutoids is much greater than might be expected from their quantity. Our experiments are still progressing and we have already established that much of the variability of the latex is due to these lutoids, the following factors being greatly influenced: mechanical and colloid stability, stability against spontaneous coagulation, viscosity, and creaming capacity.

The intensity of the yellow color of the latex does not depend on the quantity of the lutoids, but on their composition. L. N. S. Homans and G. E. Van Gils, Netherlands Indies Institute for Rubber Research, Buitenzorg, Java.

**Studies in the Coagulation of Preserved Latex by Sodium Silicofluoride.** This paper describes extended experimental work on the gelling behavior of sodium silicofluoride, particularly as exemplified by the pH at which gelling occurs.

The influence of zinc oxide, surface-active substances, and the nature of the latex on the gelling pH is examined, and tentative hypotheses are put forward as to the significance of the values obtained in relation to other tests for the chemical stability of the latex, such as the KOH number and Z.O.T. value.

Some further evidence is adduced for

the dual character of the sodium silicofluoride gelling phenomena supporting the possible contribution of silicic acid to the formation of the gel.

Santobrite-preserved latex is very stable to the action of sodium silicofluoride alone; it is, however, comparable in gelling pH with other latices in the presence of zinc oxide when the original alkalinity is raised to 0.5% NH<sub>3</sub>. It differs from other latices in being more stable to gelling by sodium silicofluoride in the presence of zinc oxide at very low ammonia contents.

Obviously, much more experimental work is required before the significance of the results obtained in this paper can be fully assessed, and such investigations are now proceeding. E. A. Murphy, E. W. Madge, D. W. Pounder, Dunlop.

**The Control of Undesirable Viscosity Increases in Latex Compounds.** A latex stabilizer of the non-ionogenic class, consisting of a fatty alcohol-ethylene oxide condensate, similar in chemical type and technological properties to Emulphor O (I.G.), is shown to be effective in controlling "zinc oxide effect" thickening and similar undesirable increases in the viscosity of compounded latex mixes, e.g., in the presence of active accelerators under conditions where an older and better known stabilizer of the anionic synthetic detergent class is not adequately effective. The proposed stabilizer may be effective in as low an amount as 1% on the rubber, and the material actually used in the experimental work was Vulcastab LW, C. F. Flint, I.C.I.

**The Preparation and Properties of Highly Purified Rubber.** A method is described of obtaining highly purified *Hevea* rubber, 99.9% pure hydrocarbon, by addition of soap to ammonia-preserved latex to displace the protein from the rubber particle surfaces, followed by repeated creaming, coagulation with acetic acid, and extraction with acetone. Prevention or limitation of oxidation of the pure hydrocarbon was obtained by work in the dark, or by treatment of the latex with pyrogallol and extraction with pyrogallol in acetone. Results are given on the vulcanization behavior of highly purified rubber, showing marked improvement in resilience, while there are remarkable differences in the mechanical properties of vulcanizates from sol and gel fractions in some mixes. G. Martin, London Advisory Committee for Rubber Research (Ceylon, Malaya).

**The Possibility of Using Tannins as Coagulants for Natural Latex.** Wartime scarcity of coagulants in the N.E.I. led to examination of tannin extracts as possible substitutes. Tannins of tea leaf and of the bark of *Acacia decurrens* were selected, and the extracts were obtained simply by stirring the materials in large bottles with cold or hot water, with a view to a process practicable on the estates.

From numerous coagulation trials it was decided that the use of tannin extracts is feasible, with some disadvantages in particular cases, and that tannins mixed with acetic acid save both acid and money at the cost of increased complications. Tannins, however, cannot be recommended except for emergency or unless some special properties of the rubbers are found. H. A. Leniger and G. Verhaar, Experiment Station, West-Java, Buitenzorg.

**The Degree of Swelling of Natural and Buna Latex Films in Water.** It has been shown that the determination of the swelling of latex films is obscured by extraction which takes place at the same time. The disturbing effect of extraction can be avoided either by swelling in water

vapor, or preferably by employing the "short swelling" technique. This provides a simple method of testing and gives more reliable results.

Films prepared from synthetic latex (Igetex SS and NN) were found to be more resistant to water than those made from natural latex when tested by the short swelling method. The opposite result is obtained by using the usual method of determining swelling, and the reasons for this difference are discussed.

A slight but insignificant improvement in resistance to water of the film can be obtained by the dialysis of the latex. O. Bachle, Farbenfabriken Bayer, Leverkusen, Germany.

SIXTH SESSION—JUNE 25—COMPOUNDING INGREDIENTS—GENERAL  
Chairman, S. A. Brazier  
Deputy Chairman, H. E. Davis

**Theory of Filler Reinforcement. II.** Modulus-type properties of loaded rubber depend mainly on the shape and the concentration of the filler particles and are almost independent of the size and the surface characteristics of the filler. The author's theory of these properties is patterned after the theory of viscosity of suspensions and implies non-specific wetting between rubber and filler particles, permitting considerable mobility of the filler particles in the rubber. Such mobility is in agreement with studies of the electrical conductivity of carbon-black loaded stocks and of the adsorption of gases by carbon blacks. Fillers with spherical particle shape like calcium carbonate and P-33 (which do not form chain-like structures) obey the theoretical equations for spherical particles. Fillers like the high modulus and the channel blacks whose primary spherical particles agglomerate into chain-like secondary particles obey theoretical equations for the secondary particles characterized by a shape factor. The assumed chain formation and the values for the shape factors are in approximate agreement with conclusions from electron micrographs. Experimental arguments are given for the validity of the theoretical equations up to 25% volume concentration, the usual technical loading. The agreement between theory and experiment is within the rather large error caused by non-uniformity between and within the test samples and in some work by the use of commercial testers, and the difficulty of comparable vulcanizations. Refinements of the theory are introduced including possible solvation, difference between the modulus of rubber in absence ("gum" stock) and in presence of the filler particles, and various degrees of wetting from non-wetting to strong wetting (implying specific chemical bonds between rubber and filler). The above-mentioned sources of error in the experimental work prohibit safe conclusions about the necessity of introducing such refinements. The experiments discussed include new measurements of stress-strain properties of loaded vulcanized stocks and of the Mooney viscosities of unvulcanized rubber-filler mixes and a discussion of the pertinent literature. For the dielectric constant of stocks loaded with fillers of spherical primary particle shape, a simple formula is derived. Eugene Guth, University of Notre Dame, Notre Dame, Ind.

**Light Phenomena on Elongating Vulcanized Rubbers.** A description is given of a light phenomenon, first observed by W. C. Smith, when carrying out tear tests on some loaded vulcanized rubbers in a dark room. This phenomenon has been

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studied more systematically by high-speed extension tests.

It appeared that this light effect had nothing to do with the choice of accelerators, but with the compounding ingredients of loaded vulcanized rubbers. In general, those compounding ingredients which belong to the filler class, such as whiting, talcum, and ground barium sulfate, show this light phenomenon very distinctly; while vulcanized rubbers with reinforcing compounding ingredients such as zinc oxide, titanium dioxide, carbon black, do not show any light effect, when quickly extended. In accordance with this point "Kelite" and "Calcene," which behave as reinforcing compounding ingredients, do not show any light phenomenon.

It seems probable that on elongating the vulcanized rubbers containing fillers the adhesion of rubber-filler particle is broken, and electrical charges appear on an extremely large surface, which lead to innumerable discharges into surrounding vacuoles, causing the general light phenomenon observed. A. Van Rossem, R.R.I., T.O.

**Effect of Pigments on Elastomer Properties.** The dependence of modulus and Shore hardness of loaded elastomers on pigment volume concentration can be quantitatively accounted for to a first approximation up to about 25 to 30% pigment volume concentration. For pigments composed of symmetrical particles equations related to those derived by Guth and Gold or by Vand for the viscosity of a suspension may be used. For asymmetrical (vermiform) particles modulus follows the Guth equation, and hardness obeys an analogous equation. The discrepancy noted at very low loadings, and associated particularly with natural rubber appears due to the effect of pigment on breakdown of the rubber.

Plasticity is primarily determined by loading, particle shape and degree of agglomerate formation (apparent shape factor), and rubber breakdown. The latter is much more important for plasticity than for properties of vulcanized rubber, which fact explains some of the difficulty previously encountered interpreting plasticity results. Leonard H. Cohan, Witco Chemical Co., New York, N. Y.

**New Principles in the Manufacture and Use of Factices and Factice-Like Materials.** This paper briefly outlines existing methods of manufacturing white and dark factices and then proceeds to describe new work designed to improve the properties of factices, with particular reference to their performance in rubber compounds. Properties covered by the new work include color, free sulfur content, ease of compounding, rate of vulcanization, mechanical properties and aging characteristics of vulcanizates, electrical characteristics. Methods adopted for influencing these properties include: (a) use of catalysts and activators, and of partially hydrogenated oils in the manufacture of dark factices, (b) use of castor oil in the manufacture of white factices, and (c) vulcanization of thermally depolymerized rubber in the preparation of a new factice-like material having outstanding properties. K. C. Roberts and J. H. Carrington, Anchor Chemical Co., Ltd., Manchester.

#### SEVENTH SESSION—JUNE 25—COMPOUNDING INGREDIENTS—CARBON BLACK

Chairman, M. M. Heywood  
Deputy Chairman, T. L. Garner

**The Nature and Activity of Carbon Black Surfaces.** While the electron microscope and adsorption isotherm tech-

niques for evaluating the particle size and surface area of carbon blacks have been particularly valuable in interpreting their behavior in rubber, they also emphasize the fact that reinforcement cannot be interpreted solely on this basis. The activity or nature of the surface must also be considered.

Heats of adsorption offer a means of evaluating surface activity. The differential heats of adsorption have been measured by precision calorimetry for nitrogen, and a series of  $C_4$  hydrocarbons on a group of carbon blacks of varying reinforcing ability. Initial sites of high activity were detected. Surface activity decreases with increasing surface coverage. The magnitude of the initial heats parallels the reinforcing properties of the blacks studied. The surface activity and reinforcing ability of an MPC black was found to be greatly reduced by high temperature treatment. These effects were not influenced by the chemical nature of the surface, i.e., the presence of chemisorbed oxygen or volatile matter.

In a further phase of this study the nature of the surface oxide complexes present on carbon blacks has been studied from their emission band spectra in a special vacuum discharge tube. Aldehyde and carboxyl radicals were observed in high concentration. Hydroxyl radicals were also present in nearly equal concentration. These data offer a satisfactory interpretation of the pH properties of carbon black and also should prove of value in interpreting other chemical properties. W. R. Smith and W. D. Schaeffer, Godfrey L. Cabot, Inc., Boston, Mass.

**The Effects of Carbon Blacks on the Viscosity of Rubber.** During the initial stage of mixing in a Banbury various carbon blacks and non-carbon pigments in rubber, the viscosity of the mix will be governed largely by the properties of the pigment. Under like conditions of mixing, particle size, surface, shape, structure, and adsorptive capacity chiefly determine the results. The viscosity of the one-minute mix of carbon blacks produced in a related process will show increasing values with an increase in surface area, oil absorption, DPG adsorption, and a decrease in the nigrometer index of the pigment. The greatest change in viscosity takes place in the first four minutes of the mixing process. The viscosity decreases more in the presence of a fine particle pigment than in the presence of a coarser one. A mathematical expression is suggested which can be fitted to the viscosity changes for a particular pigment. Different types of carbon blacks can be made to produce the same viscosity during initial stages of mixing with rubber by varying their loading. Viscosity measurements likewise reflect the extent of wetting and progress of dispersion of each pigment in the rubber. The carbon black with the largest particle size appears to be much better dispersed at the end of one minute of mixing than the carbon black of the smallest particle size. There is a wide spread in the viscosity produced by these two blacks in the one-minute mix. The effect of mixing temperature on the viscosity of rubber during its initial stage of mixing with carbon blacks of different particle size is probably slight since the temperature rise is but  $10^{\circ}$  F. Some of the non-carbon pigments produce in the initial stage of mixing a higher viscosity than that caused by some SRF blacks, but progressive milling results in lowering the viscosity more than does any one of the carbon pigments. I. Drugin, United Carbon Co., Inc., Charleston, W. Va.

**Structures in Rubber Reinforced by Carbon Black.** The stiffening action of carbon black in rubber is due to the structures formed by carbon-rubber bonds and coherent chains of particles. The softening which occurs during prestressing cannot be explained by broken chain structure, and it is thought that substantially the whole of this softening is due to ruptured carbon-rubber bonds. Prestressing does not affect the characteristic chain structure of the black particles; it breaks relatively weak fortuitous chain structures, formed by reversible Van der Waals forces between particles, which contribute little to the stiffness of the product except perhaps at small stresses.

Heating tends to reform the fortuitous structure owing to the thermal movement of the rubber molecules, which pulls them from between adjacent particles so that full contact is established. The majority of carbon-rubber bonds are relatively weak and readily broken by stressing. Besides these low-order physical bonds a comparatively few strong bonds stiffen the rubber considerably at high stresses and are mainly responsible for increasing the tensile strength and abrasion resistance. Such high energy linkages are possible only at localized areas on the particles. A. F. Blanchard and D. Parkinson, Dunlop.

**The Compounding Significance of Carbon Surface, Structure, and pH.** Three fundamental characteristics of carbon pigments: namely, surface, reticular chain structure, and pH are described, and the broad significance in rubber compounding is discussed. As a class, carbons produced by the furnace process differ from channel carbon in respect to these properties. Differences in vulcanization and other compounding effects are brought out, employing, as an example, a newer furnace carbon capable of developing tire tread performance superior to that of channel carbon stocks.

Such furnace carbon is not acidic and, in common with other carbons made by this type of process, does not retard vulcanization. Used in tread loadings, vulcanization proceeds as in an otherwise similar formulation containing no carbon. A difference in vulcanization mechanism is indicated.

Since adjustment of accelerator alone results in loss of quality, possibilities in the way of sulfur reduction have been studied. It is concluded on the basis of experimental data, which are presented, that in the presence of 1 PHR benzothiazyl sulfenamide, 2.25 PHR sulfur is adequate. It is shown that quality is impaired if appreciably less sulfur is employed.

Experimental evidence is included indicating that no less than 3 PHR of zinc oxide should be used and that at least 2 PHR of fatty acid, as stearic, should be present with this very fine furnace carbon. Other considerations necessary to the formulation of a practical compound are discussed with view to the influences of surface and structure. An approach to a formulation suitable for tire treads is outlined.

Suggestions for curative adjustment with blends of channel black and fine furnace carbons are advanced. In view of the present-day economics of the carbon industry and the commercial availability of new very high reinforcing furnace carbons, it is suggested that the full possibilities of these now deserve detailed investigation in all branches of the rubber industry where maximum performance is required, and particularly for dynamic reinforcement. Donald F. Cranor, Binney & Smith Co., New York.

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**Factors Affecting the Power Consumption of Pneumatic Tires.** Power consumption, or rolling resistance of pneumatic tires, continues to receive close attention of tire compounders and designers. The power consumed by the rolling tire is, of course, wasted; it represents an ever-present drain on the fuel supply and contributes nothing to driving the vehicle. Moreover this wasted energy is converted into heat which raises the temperature of the tire itself, thereby reducing its ability to resist abrasion, separation, flex fatigue, bruising, and blow-out. In truck or giant sizes the temperature so developed becomes indeed the limiting factor of tire performance in high-speed, intercity, commercial operations.

Numerous factors, some external and some internal, affect to varying degrees the level of rolling resistance, which for passenger sizes currently ranges from 12 pounds to 20 pounds per 1,000 pounds of load carried, and from eight pounds to 12 pounds per 1,000 pounds of load for over-the-road commercial sizes.

As for external factors or operating conditions, tire drag is increased by an increase of speed, of load, and of tractive force between tire and road; it is decreased by an increase of inflation pressure. When the tire is mounted on a rim approximately 70% as wide as the tire itself, rolling resistance is somewhat less than with either wider or narrower rims.

Rolling resistance is decreased by an increase of temperature, whether caused by the tire's own hysteresis or by ambient conditions. This circumstance is fortunate because it permits the tire to carry heavier load at higher speed than would otherwise be the case.

As for materials, the nature of the cord used has a relatively small and probably indirect effect. Of much greater influence is the nature of the rubber materials; for tires using all-synthetic rubber compounds the drag may be 50% higher than if the tire were compounded from the best grades of the natural product. R. D. Evans, Good-year.

**Applications of a High-Tenacity Rayon in the Rubber and Plastics Industries.** "Fortisan" has a higher degree of orientation, and a higher strength and modulus of elasticity, than any other form of regenerated cellulose rayon. It is suitable for the construction of mechanical fabrics where strength, resistance to stretch, and dimensional stability are of prime importance. Among regenerated cellulose yarns, "Fortisan" has a position corresponding to that occupied by flax among natural cellulosic fibers.

Conveyer belting made from "Fortisan" in comparison with cotton belting, have 15% more strength, 80 to 140% longer life, 50 to 60% of the weight of reinforcing material; they are easier to handle, have good impact strength, ample ply adhesion, tough well without spillage, and stretch less.

For high-duty belting "Fortisan" should prove of value, particularly with the use of new constructions permitting the strength of the warp ends to be more fully realized. Examples are given to show that unconventional cloth constructions allow the strength, expressed as the fabric strength weight ratio, or as tenacity calculated on the warp threads only, to be increased several times.

"Fortisan" tire cords have been used successfully in aero and road tires because of lightness and high impact strength. Examples given show the effect of twist on strength and extension.

In phenolic laminates the use of "Fortisan" instead of cotton for reinforcement results in 25% greater shear strength and 100% greater tensile strength, cross-breaking strength, impact strength, and modulus of elasticity.

"Fortisan" can be used advantageously in V-belt, transmission belting, footwear, rainwear, fire hose, diaphragms, printers' blankets, rubber treated cords, and support for rubber sheeting. D. Finlayson and T. Jackson, British Celanese, Ltd.

**The Testing and Use of Man-Made Fibers in Tire Construction.** The static and dynamic characteristics of high-tenacity viscose rayon have been examined and discussed. Special emphasis has been placed on newly developed fatigue tests in relation to the use of these rayons in car and lorry tires. In this connection the work of Bächle and Dane is specially mentioned.

High-tenacity viscose rayon is definitely superior to cotton for the construction of tires. Tires made with it have the following outstanding advantages: (1) better tensile strength characteristics especially at high temperatures—hence thinner, lighter, and more flexible carcasses can be used; (2) better temperature balance on the road as a result of more favorable hysteresis behavior as well as reduced wall thickness; (3) higher fatigue resistance; (4) smaller resistance to rolling.

On account of these superior mechanical and thermal properties, tires can be made with longer working life and a greater safety factor. These improvements in technical efficiency and economic advantages are apparent for tires of all dimensions and uses.

High-tenacity viscose rayon, the development of which is still in progress, and nylon or Perlon yarns, which also have interesting properties, will therefore be the favored textile materials for the construction of tires for power driven vehicles in the coming years. G. Fromandi, Farbenfabriken Bayer.

**Latex-Reclaim-Casein Mixtures for Rubber-Cord Fabric Adhesion.** A good bond, resistant to flexing, is afforded between rubber and rayon cord by the interposition of a mixed casein-rubber film. In a series of solutions in which the amount of rubber solids was kept constant and the quantity of casein varied progressively, it was found that there was an optimum amount of casein for maximum adhesion. Taking into consideration also the handling of the solution and the stiffening of the cord, it would appear that for an adhesive with the usual total solids content of 15 to 20%, the ratio of casein to rubber hydrocarbon should be approximately 1:6.

When the rubber hydrocarbon content is supplied by dispersed reclaim, the adhesion is a little higher than when latex is used. The most satisfactory solution from all points of view, however, contains approximately equal quantities of rubber hydrocarbon derived from the two sources.

Wetting agents may be employed to improve the uniformity of application of the adhesive. The amount used must be quite small; otherwise the adhesion is impaired.

It has been shown by dipping cord successively in casein and latex solutions and vice versa that in the adhesive film casein acts as a specific adhesive for rayon; whereas the rubber in the film gives the necessary affinity for the casing rubber which surrounds it. Treating a cord successively in a casein-rich mixture and then in a rubber-rich mixture appears to give a slightly better bond than the conventional treatment.

The subsequent application of a rubber cement to a cord dipped into latex-reclaim-casein solution results in an improvement in the bond. E. R. Gardner and P. L. Williams, Avon India Rubber Co., Ltd., Melksham, England.

## OTS to Continue Services

**T**HE Office of Technical Services will continue its services to business and industry in the next fiscal year in a somewhat condensed form, Director John C. Green announced on July 1. Beginning in July the "Bibliography of Scientific and Industrial Reports" will be published monthly instead of weekly and will appear in a less expensive format. Mr. Green said. Each monthly issue will list about 2,000 titles of OTS reports, but will contain very few abstracts. Yearly subscriptions to the Bibliography will cost \$10 (\$14 foreign); while single copies will sell for \$1 (\$1.50 foreign). As in the past, OTS will print and sell copies of outstanding reports and documents for which there is considerable demand. Orders for photostat and microfilm copies of OTS reports, however, will be referred to the Library of Congress, which has agreed to handle this material.

Last year OTS handled about 85,000 requests for information about industrial processes. With a reduced staff it will be impossible to take care of any such number of inquiries in the next fiscal year, Mr. Green explained, but as many inquiries as possible will be answered. Special efforts will be made to prepare form replies for inquiries which recur frequently, and no inquiries will be handled which require individual research.

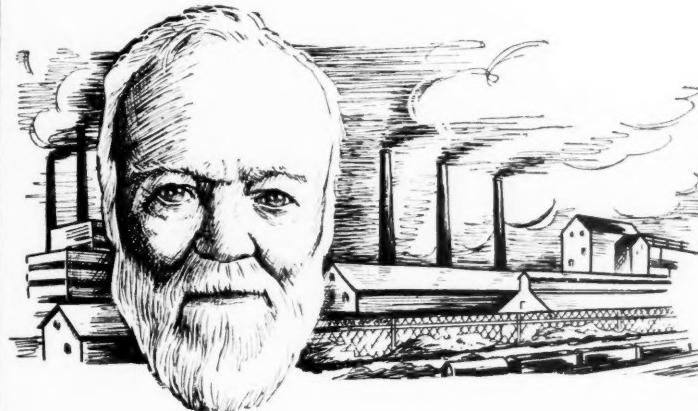
## Pelletized Good-rite Erie

**T**HE commercial production of Good-rite Erie in a new, easy processing pelletized form has been announced by the B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, O., manufacturer of this accelerator. Formerly supplied as a rubber-soluble liquid, Good-rite Erie is now available in dustless, free-flowing black pellet form containing 50% active agent adsorbed on easy-processing carbon black. Liquid Good-rite Erie will be supplied hereafter only in limited quantities and upon special request.

Good-rite Erie is an excellent delayed-action accelerator for nearly all types of compounds from natural rubber, GR-S, reclaimed rubber, and GR-S-natural rubber mixtures. The accelerator is also said to have excellent solubility in rubber, good processability with freedom from scorch, and to develop excellent low hysteresis properties with good flex resistance in properly balanced compounds. The new pelletized form offers the following advantages: it is currently furnished in standard Leverpak fiber drums which allow easy handling and warehousing; its physical form eliminates the need of preparing a rubber masterbatch of the accelerator prior to use in a final compound; and it has good chemical stability.

# TALES WORTH RETELLING

(No. 7 of a series)



ANDREW CARNEGIE once had as an employee a young man of exceptional ability and ambition. His name was Charles M. Schwab. The little Scotchman taught him many things. One of which was the hard lesson of the commercial world that one day's laurels are of little use on the next.

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## A. C. S. National Meeting

APPROXIMATELY 15,000 chemists and chemical engineers will participate in the one hundred and fourteenth meeting of the American Chemical Society, which will be held in three sessions: an Eastern Session, in Washington, D. C., August 30 to September 3; a Midwest Session, in St. Louis, Mo., September 6 to 10; and a Western Session, in Portland, Oreg., September 13 to 17. The divided national meeting, first in the Society's 72 year history, was arranged to enable the maximum number of the 57,000 members to attend, according to A.C.S. president, Charles A. Thomas, of Monsanto Chemical Co.

Recent developments in virtually every field of chemical science and technology will be reported in several hundred papers at a total of 120 technical sessions during the three meetings. Seven divisions of the Society will participate in the Washington meeting, which will also feature the presentation of three awards, the Garvan, Lilly, and Paul-Lewis awards. The St. Louis meeting will feature the high polymer forum, sponsored by the organic, cellulose, colloid, plastics, petroleum, rubber, and physical and inorganic chemistry divisions. Cheves Walling, United States Rubber Co., will preside at the forum. Several other divisions will also participate in other technical sessions at this meeting, which will include presentation of the Priestley and the Fisher awards. The Portland meeting will stress recent achievements of the nuclear chemist in atomic energy, the biological chemist in animal nutrition, and the wood chemist in deriving sugars from wood.

The Division of Rubber Chemistry, as reported previously, will not schedule any divisional programs in any of these three sessions, but will meet separately in Detroit, Mich., in November.

prizes were distributed to the following: low gross, Ron Hannon and A. Nelson; high gross, J. Smith; longest drive, C. P. Taylor; jack-pot hole in one, Bob Kreuz and John Arend; and kickers' handicap, F. E. Johnson, F. W. Steese, G. Toivonen, Lee Jackson, L. H. Bell, W. F. Anderson, Ken White, Ralph Randall, Ed Coe, N. E. Toonder, Ralph Huizinga, M. R. Steere, and D. McMinn. Door prizes were won by John Arend, J. W. Hooper, F. L. Kilbourne, F. R. Newell, R. F. Anderson, M. R. McCauley, D. A. Brown, W. H. Bohnhoff, Al Stein, G. R. Cuthbertson, A. C. Chadwick, W. C. Christopher, and J. T. Black.

The outing was voted a huge success, and much appreciation went to the outing committee chairman by T. W. Halloran, Chemical Products, Inc., assisted by G. B. Horsfall and E. J. Kvet, American Brakeblok Co.

The Group's next meeting will take place on October 1 at the Detroit Leland Hotel, Detroit, at which time L. R. Sperberg, Phillips Petroleum Co., will speak on "Carbon Black in Low-Temperature Chemical Rubber."

in getting the new section started, also gave a brief talk.

Charter members present at the meeting included: George L. Allison, of Goodrich, head of product specifications with the Office of Rubber Director during the war; E. B. Babcock, director of Firestone chemical laboratories and an assistant director of ORR; Ernest R. Bridgwater, one time Firestone and Goodrich compounder, now manager of the rubber chemicals division, E. I. du Pont de Nemours & Co., Inc.; J. Harvey Doering, former Firestone compounder now with R. T. Vanderbilt Co.; Herbert A. Endres, assistant director of research at Goodyear Tire & Rubber Co.; Henry J. Flikkje, senior compounder at Goodrich; Harold Gray, technical superintendent of Goodrich tire division and early discoverer of non-accelerating antioxidants; Maurice A. Knight, president of Knight Stoneware Co.; Harold A. Morton, former Miller research chemist, now president of Rubber-Latex Products, Inc.; George Oenslager, retired Goodrich research man who has won the Perkin and the Goodyear medals for his discovery of organic accelerators; James W. Schade, formerly of Goodrich and now manager of the Government Synthetic Rubber Laboratory; L. B. Sebrell, director of research at Goodyear and winner of the Goodyear medal for his pioneer work on Captax; Norman Shepard, former research director of Firestone, now chemical director of the rubber chemicals department of American Cyanamid Co., and a member of the Baruch Committee and a past chairman of the American Section of the Society of Chemical Industry; J. R. Silver, formerly of Goodrich and now president of Akron Chemical Co.; Frederick W. Stavely, research director of Firestone; Fred C. Theiss, once a Miller compounder, but now head of technical service at General Tire & Rubber Co.; Herman R. Thies, head of the Goodyear chemical division; and Walter W. Vogt, development manager of Goodyear.

Of the living charter members who were absent, the one with the best excuse was probably Ray P. Dinsmore, vice president of Goodyear, who was in London receiving the I.R.I.'s Colwyn Medal on the same night.

Other charter members unable to attend included: Harry L. Arbogast, ex-Goodyear, now manager of the rubber department of Phoenix Mfg. Co.; David J. Beaver, formerly at Firestone, but now in St. Albans, W. Va.; C. W. Clifford, ex-Goodyear, now residing in Canoga Park, Calif.; Benton Dales, one-time Goodrich compounder, now a consultant in Media, Pa.; John B. Dickson, ex-Goodrich, now living in New York; Walter W. Evans,

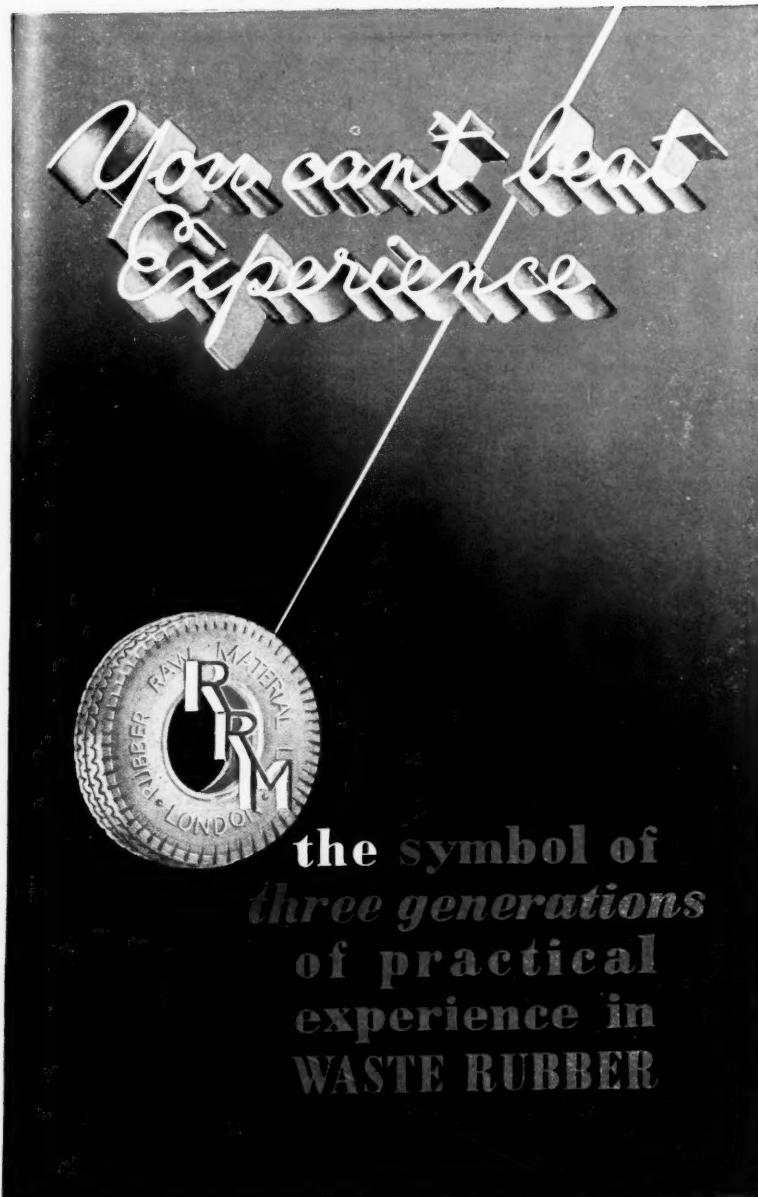
## Detroit Group Outing

THE Detroit Rubber & Plastics Group, Inc., held its annual summer outing on June 25 at the Forest Lake Country Club, Pontiac, Mich. Approximately 200 members and guests attended, including many ASTM members who were in Detroit for the Society's annual meeting.

The feature of the outing was the afternoon golf tournament, with a German Band sending the contestants off on the first tee with appropriate music. Dinner was served in the evening, followed by card parties and social gatherings. Golf



Among Those Present at Detroit Group Outing were (L. to R.) J. Zeller, Godfrey L. Cabot, Inc.; J. Bowers, Piqua Stone Products Co.; C. R. Shaffer, Xylos Rubber Co.; R. Heydorn, Baldwin Rubber Co.; E. Wallace, G. R. Cuthbertson, R. R. Miller, and J. Deres, all of United States Rubber Co.; and the German Band



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ex-Goodyear, now technical supervisor of Boston Woven Hose & Rubber Co.; Roland R. Etter, ex-Goodyear, now residing in Monroe, Wis.; Harry L. Fisher, former Goodyear research man, now research director of U. S. Industrial Chemicals; William C. Geer, one-time head of Goodyear research, inventor of the Geer aging test, author of "The Reign of Rubber," now living in Ithaca, N. Y.; A. E. Hardgrove, former Akron city chemist, now superintendent of Norton Infirmary, Louisville, Ky.; Webster N. Jones, formerly in charge of Goodrich technical work, now dean of engineering at Carnegie Institute of Technology; Paul W. Litchfield, chairman of the Goodyear board; F. H. Martin, of Goodrich, now with Hood Rubber Co.; H. B. Pushee, development director at General; R. B. Stringfield, ex-Goodyear, now president of Fullerton Mfg. Co., Fullerton, Calif.; Harlan L. Trumbull, assistant to director of research at Goodrich; Ira Williams, formerly with Firestone, now research director of J. M. Huber Corp., and another Goodyear medalist; Herbert A. Winkelman, ex-Goodyear, now research director of Dryden Rubber; E. C. Zimmerman, chief chemist of Firestone; H. J. Stockman, Goodyear; and R. G. Smith, address unknown.

Deceased members and their business connections in 1923 are: C. W. Bedford and A. B. Merrill, Goodrich; A. M. Hamblett and Ellwood B. Spear, Goodyear; M. M. Harrison, Miller; Arthur E. Warner, Firestone; and C. B. Tavenner.

### New York Group Outing

THE annual outing of the New York Rubber Group was held at Doerr's Grove, Milburn, N. J., on Saturday, June 20; Saturday was selected instead of the usual Friday at the suggestion of many members. Fortunately it proved one of the few comparatively rainless days in several weeks, and the 140 members and guests who attended the affair had an enjoyable afternoon of games, with plenty of beer and food for refreshment.

Those who triumphed in the various games and contests were: *horseshoe pitching*, first prize, W. L. Lamela, Okonite Co. and R. S. Potter, Armstrong Rubber Co.; *bocce*, George McNamara and Warren Carter, Pequano Rubber Co.; *darts*, Bert Wilkes, Godfrey L. Cabot, Inc., and Mr. McNamara; *baseball throw*, Russ Kurtz, E. I. du Pont de Nemours & Co., Inc.; *egg throw*, W. S. Kane, Okonite, and Ted Bogosian, American Hard Rubber Co.; *fat man's race*, Mr. McNamara; *three-legged race*, M. J. D'Asaro and R. J. Margles, Wolf-Alport Chemicals, Inc.; *sack race*, Mr. Margles; *softball*, team captained by Cliff Ayers, Flintkote Co.; *tug of war*, team captained by George Jerolman, Armstrong.

The events were handled by the following: *softball*, Howard Ling, Naugatuck Chemical Division, United States Rubber Co.; *darts*, M. E. Lerner, *Rubber Age*; *bocce*, Bob Carroll, R. E. Carroll, Inc.; *horseshoes*, Mr. Lamela; *three-legged race*, *fat man's race*, and *baseball throw*, Mr. Ayers; and *sack race*, *egg throw*, and *tug of war*, Harry Eckhardt, Lea Fabrics, Inc.

The outing committee consisted of Charles T. Jansen, *Rubber Age*; M. R. Buffington, Lea Fabrics; and Peter Murawski, du Pont. This committee worked hard to make the affair a success, and the results were most satisfactory.

### Silicone Rubbers and Fluids

A TALK on "Silicone Fluids and Silicone Rubbers," by Robert B. Stewart, Dow Corning Corp., featured the June 24 meeting of the Northern California Rubber Group. The meeting, held at the Claremont Hotel, Berkeley, was attended by 40 members and guests, including Miss Ethel Levene, secretary of the newly formed Washington Rubber Group.

Mr. Stewart stated that the silicone fluids being used in the tire and rubber industry as mold lubricants offer the advantages of cleaner molds, added luster, economy and ease of application, and uniformity of product. These advantages are derived from the inherent heat stability, inertness, and incompatibility of the silicones with the synthetic elastomers. Silicone mold release fluid is diluted with petroleum solvents, or applied from a water emulsion. A silicone concentration of 0.5-1% is normally desirable; it is important to avoid excessive concentrations. Other miscellaneous uses for the silicone fluids in rubber manufacturing plants include corrosion prevention of molds and the improvement of the service life of automatic connector gaskets.

Silastic silicone rubber is resistant to abnormally high- and low-temperature applications, the speaker declared. It also offers excellent resistance to weathering, oxidation, ozone, hot lubricating oils, and a variety of chemicals. The electrical properties of Silastic are comparable to those of organic rubbers at room temperature and are superior at high temperatures to the best resilient insulating materials currently available. After a brief discussion of the molecular structure of silicone rubber, Mr. Stewart further said that all types of Silastic will withstand continuous exposure to temperatures up to at least 300° F., a minimum advantage of 100° F. over organic rubbers. If protected from the atmosphere, Silastic will withstand a continuous temperature of 300-500° F. and intermittent exposure to temperatures over 500° F. Silastic is especially useful as a gasketing material in the aircraft industry and is being adapted to automotive uses. It is frequently reinforced with Fiberglas for making flexible ducts and couplings as well as gaskets. The speaker concluded with a review of other applications of Silastic, including Grippmats, a deluxe household hot pad holder made from sponged Silastic, which provides heatproofness, waterproofness, and slipproofness.

At the Group's business session, Victor F. Sagues, Sacomo Mfg. Co., resigned as secretary because of the press of business affairs. Robert R. James, Rubber Laboratory, Mare Island Naval Shipyard, was appointed Group secretary for the remainder of the year. William E. Elwell, California Research Corp., committee chairman for the summer outing, reported that all arrangements have been made for the outing which will be held at Curry Creek Park, near Oakland, on August 15. Russell D. Kettering, Oliver Tire & Rubber Co., and Herman J. Jordan, E. I. du Pont de Nemours & Co., Inc., will be in charge of athletic events at the outing; while George I. Petelin, Goodyear Rubber Co., will oversee liquidation of the "slush fund."

Two door prizes were distributed. A Ronson cigarette lighter, donated by Harwick Standard Chemical Co., was won by John A. Lillegren, Pioneer Rubber Mills; and a Silastic Grippmat hot pad holder, donated by Dow Corning Corp., was won by Thomas B. Squires, also of Pioneer. The Group will meet again October 28.

### Quebec Group Golf Outing

THE Quebec Rubber & Plastics Group held its annual golf tournament on June 25 at the Granby Golf & Country Club, Granby, P. Q., Canada. Approximately 60 members and guests participated in the tournament and partook of dinner at the Granby Hotel. After dinner A. Stuart MacLean, retiring chairman, announced that the current publicity chairman, Frank D. Cobbett, Canadian General Electric Co., Ltd., would be Group chairman for the coming year. Other new members on the executive committee are: H. A. Hencher, H. L. Blachford, Ltd.; G. Rea, Monsanto Chemical Co.; R. M. Powell, Canadian Industries, Ltd.; W. Gedye, Miner Rubber Co., Ltd.; and H. Brennan, Dominion Rubber Co., Ltd. Prizes donated by some 27 rubber and supplier companies were presented to winners in the golf tournament by Mr. MacLean and Mr. Cobbett.

### Industrial Chemical Conference

THE National Industrial Chemical Conference will be held October 12 to 16, concurrently with the National Chemical Exposition and under the same roof at the Chicago Coliseum. The Conference program is designed to be of particular help to the chemical consuming industry and small business firms and will consist of 18 talks by world-famous speakers on subjects of interest to both technical and executive personnel.

Charles L. Thomas, chairman of the Chicago Section, American Chemical Society, sponsor of the Conference and Exposition, has announced that the first day of the Conference, October 12, will include three speakers on the general subject of "Chemical Markets." On Wednesday afternoon, October 13, five speakers will talk on "Chemistry in General Industry"; while the evening program will consist of three speakers on the general subject of "Hazards from Chemicals."

The program for October 14 is not complete as yet, but will be on the subject of "Management of Research." On Friday afternoon, October 15, four speakers will discuss, "Frontiers of Chemistry," and three talks will be given that evening on "Pilot-Plant Use by the Chemical Industry."

### Chicago Golf Outing

THE Chicago Rubber Group held its annual golf outing on July 17 at the Acacia Country Club. Approximately 220 members and guests attended the dinner, and nearly 175 players participated in the golf tournament. Arrangements for the outing were made by a committee consisting of Chairman Maurice J. O'Connor, C. P. Hall Co.; Dwight E. Smith, Inland Rubber Co.; Robert L. Campbell, New Jersey Zinc Sales Co.; John Gallagher, Allis Rubber Co.; Ed Meyer, Herron & Meyer of Chicago; Charles Skuza, also of Inland; and Charles Wonder, Van Cleef Bros. Division of Johns-Manville Corp.

The United Carbon Trophy, donated by Charles Baldwin and awarded annually to the Group member having the lowest gross score, was won for the second time

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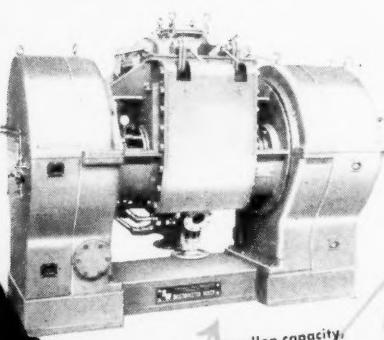


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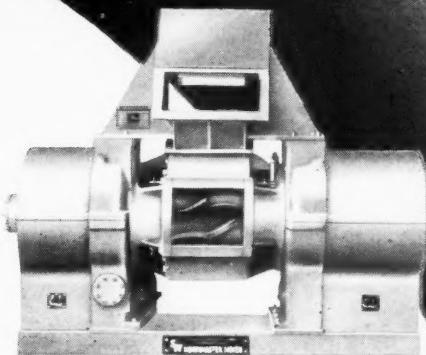
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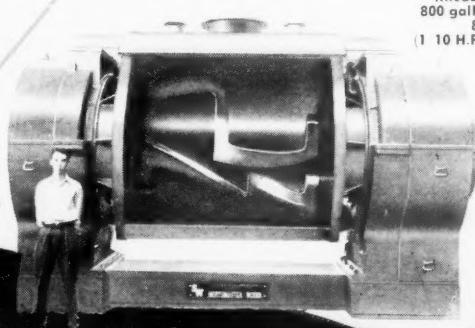
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Intensive Mixer, 5 gallon capacity,  
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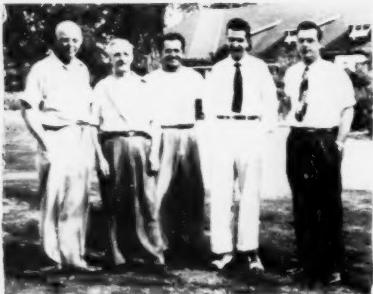
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Some Members of the Committee for the Chicago Group Outing: (L. to R.) Ed Meyer, Charley Wonder, Charley Skuzza, Maurice O'Connor, and Bob Campbell

by Jim Adams, Sears Roebuck & Co. Merchandise prizes were awarded to the following golfers for low gross score: first, Don Zimmerman, United States Rubber Co.; second, Joe Smith, Brunswick-Balke-Collender Co.; third, A. E. Barkett, B. F. Goodrich Co.; fourth, Mr. Adams; and fifth, L. B. Wagner, Metropolitan Golf Ball Co. Prizes for low net score by the Peoria system went to: first, C. J. Oshinski, U. S. Rubber; second, M. Neery; third, Jack Leeds, Leeds Rubber Co.; fourth, Mr. Skuzza; and fifth, B. F. Benson. Winners for low net score using the blind bogey system were: first, F. E. Witherell; second, W. J. Bieberle; third, Mr. Meyer; fourth, C. O. McNeer; and fifth, M. Weintraub. Winners of special prizes were as follows: lowest number of putts, Mr. Barkett; most honest golfer, A. H. Krause, Marbon Corp.; and most balls in the water, A. J. Kraft, Kraft Chemical Co.

As a climax, door prizes worth more than \$4,500 were awarded to the dinner guests under a system whereby each person received either a door prize or a golf prize. The grand door prize, a matched set of leather luggage, was won by Calvin S. Yoran, Brown Rubber Co.

The Group will hold its next meeting of September 24 in the Morrison Hotel, Chicago, Ill. The meeting will be of the split type with a technical session to be held from 4:00 to 5:30 p.m., a social hour from 5:30 to 6:30 p.m., dinner from 6:30 to 8:00 p.m., and a popular after-dinner speaker starting at 8:30 p.m.

### R. I. Club Golf Outing

APPROXIMATELY 110 members and guests of the Rhode Island Rubber Club attended the annual golf outing on June 24 at the Pawtucket Golf Club, Pawtucket. The program included an afternoon golf tournament, in which some 47 members and guests participated, followed by a dinner in the evening. Prizes made available through the courtesy of 53 rubber and supplier companies were distributed to the following winners in the golf tournament: low gross, W. A. Maguire, United Carbon Co.; second low gross, tied by R. S. Newman, Respro, Inc., and F. F. Salamon, Binney & Smith Co.; kicker's handicap, W. Platt, Columbia Chemical Division of Pittsburgh Plate Glass Co., S. Burt, and Al Perry, E. I. du Pont de Nemours & Co., Inc.; most 5's, Bill Stafford, Interlaken Mills, Inc.; most 6's, Herb Hanson; most 7's, Dick Sanderson, United States Rubber Co.; and high gross, W. Coleman.

### CALENDAR

- Aug. 14. Connecticut Rubber Group. Outing.
- Aug. 15. Northern California Rubber Group. Summer Outing. Corry Creek Park.
- Aug. 20. Chicago Section, SPE. Annual Golf Outing.
- Aug. 23. City of New York. Golden Anniversary Exposition. Grand Central Palace, New York, N. Y.
- Sept. 19. New York Rubber Group. Annual Golf Tournament. Winged Foot Golf Club. Mamaroneck, N. Y.
- Aug. 30. American Chemical Society, National Meeting, Eastern Session. Washington, D. C.
- Sept. 2. New Orleans Section, SPE. New Orleans Hotel, New Orleans, La.
- Sept. 6. A.C.S. National Meeting, Midwest Session, St. Louis, Mo.
- Sept. 13. A.C.S. National Meeting, Western Session, Portland, Oreg.
- Sept. 14. New York Section, SPE. Hotel Sheraton, New York, N. Y.
- Sept. 17. Philadelphia Rubber Group. Annual Outing. Oak Terrace Country Club.
- Sept. 17. Southern Ohio Rubber Group. Engineer's Club of Dayton, Dayton, O.
- Sept. 21. Buffalo Rubber Group. Westbrook Hotel, Buffalo, N. Y.
- Sept. 24. Boston Rubber Group. Somerset Hotel, Boston, Mass.
- Sept. 27. Third National Plastics Exposition. Grand Central Palace, New York, N. Y.
- Oct. 1. Detroit Rubber & Plastics Group, Inc. Detroit-Leland Hotel, Detroit, Mich.
- Oct. 5. The Los Angeles Rubber Group, Inc. Hotel Mayfair, Los Angeles, Calif.
- Oct. 5-7. New England Materials Handling Exposition. Mechanics Hall, Boston, Mass.
- Oct. 12. Washington Rubber Group.
- Oct. 12-14. National Chemical Exposition and National Industrial Chemical Conference. Coliseum, Chicago, Ill.
- Oct. 13. Newark Section, SPE. Newark Athletic Club, Newark, N. J.
- Oct. 15. New York Rubber Group. Henry Hudson Hotel, New York, N. Y.
- Oct. 19. Buffalo Rubber Group. Westbrook Hotel, Buffalo, N. Y.
- Oct. 20. South Texas Section, SPE. Ben Milam Hotel, Houston, Tex.
- Oct. 28. Northern California Rubber Group.
- Nov. 3-5. American Society of Body Engineers, Inc. Annual Convention. Rackham Memorial Bldg., Detroit, Mich.
- Nov. 8-10. Division of Rubber Chemistry, A.C.S. Book Cadillac Hotel, Detroit, Mich.
- Nov. 9. Washington Rubber Group.
- Nov. 18. Rhode Island Rubber Club. Crown Hotel, Providence, R. I.
- Nov. 18. Northern California Rubber Group.
- Dec. 3. Philadelphia Rubber Group.
- Dec. 7. The Los Angeles Rubber Group, Inc.
- Dec. 10. New York Rubber Group. Christmas Party. Henry Hudson Hotel, New York, N. Y.

### Polystyrene Molding

(Continued from page 674)

which, he said, is becoming increasingly important as a plastic raw material. Polystyrene molding granules are being sold at the rate of about 9½ million pounds a month, as compared with 18 million pounds of phenolics. Polystyrene is now being used in thousands of applications and is being put into many other uses as quickly as new developments are made.

Much is being asked of polystyrene which was not possible two or three years ago, the speaker said. Among the new applications are large area moldings of thin sections. Improved clarity and heat resistance are demanded; extremely heavy sections are being molded; and the number of molding cycles per hour is being steadily advanced. The result of these demands has been that material manufacturers, product designers, mold designers, molders, industrial or secondary users, and the general public have had to learn a great many points on how to deal with this highly useful plastic.

A large proportion of the polystyrene being made today is injection molded. Some of the problems which occur frequently in such molding are: (1) product design to take advantage of the material's favorable qualities and avoid unfavorable properties; (2) selection of the proper polystyrene formulation for general purposes; rapid molding, heat resistance, impact resistance, light stability, and special purposes; (3) mold design; (4) mold release; (5) bubbles and shrink marks; (6) surface defects in molded articles; (7) pressure and temperature limitations; (8) rate machine capacity versus actual molding weight; (9) color; (10) heat resistance versus part design and molding conditions; (11) arrangement of cavities; and (12) selection of molding materials. The remainder of the talk was devoted to a discussion of these problems, their interrelation, and their cure or their avoidance.



Underwood & Underwood

Pictured at a recent informal gathering in New York are these members of the Muehlstein family, all active in H. Muehlstein & Co., Inc., New York, N. Y., nationally known rubber and plastics firm. Seated in front is Herman Muehlstein. Standing, left to right, are Charles Muehlstein, Julius Muehlstein, and Herbert I. Muehlstein, son of Charles.

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Accelerator 49

## ACTIVATORS

Aero AC 50

## PEPTIZER

Pepton 22

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Plasticizer 42 (For Neoprene)

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# RUBBER WORLD

## NEWS of the MONTH

### Highlights—

Another round of price increases for tires and tubes has begun; while prices for rubber covered wire and cable are also advancing. The rubber industry's production rate is high, and prospects are good for attaining even higher levels. Mechanical goods production and demand are very high, and increases in

production of tires and tubes are also noted. A new estimate of world rubber production exceeds previous predictions and appears sufficient to satisfy the needs of another domestic one-million-ton-consumption year. On the labor front, companies are following the 11¢ wage increase formula. Agreements were also reached by Seiberling and Kelly-Springfield, and other contract negotiations are in progress.

### Increases in Tire and Tube Prices are Announced; Mechanicals Pace High Rubber Production Rate

Price increases of 4½-7½% for tires and inner tubes were announced last month by eight rubber companies, including three of the Big Four. These increases were apparently precipitated by the third round of wage increases granted by the industry, although rising costs of raw materials, transportation, and other items were also contributing factors. Prices of rubber products other than tires and tubes were also rising, with price increases for wire and cable products announced by three companies.

Production rates in the rubber industry are high and expected to go even higher, particularly in the mechanical goods branch. Company spokesmen say their mechanical goods production and sales are running 10-20% over 1947 levels and have resulted in plant expansions. The high production rate of the industry as a whole is exemplified by consumption statistics for June being 9% over May figures, which in turn were higher than April levels. A slight increase in the consumption ratio of GR-S to total rubber consumed was noted for both May and June and represented a healthy sign in view of large GR-S stockpiles and declining natural rubber receipts.

New estimates of world production of natural and synthetic rubber in 1948 predict the availability of about 2,000,000 long tons, of which some 1,175,000 tons should be available to the United States. This total plus ample supplies of reclaimed rubber satisfy both government stockpile and domestic production requirements.

#### Higher Costs—Higher Prices

The third round of wage increases granted by the major companies during the last month, and in effect setting the pattern for the industry, was apparently the extra pressure on prices that could no longer be withstood. Three of the Big Four companies, United States Rubber Co., The B. F. Goodrich Co., and Goodyear Tire & Rubber Co., all raised the prices of their tires and tubes by about 4½ to 7½% during the first part of July. Seiberling Rubber Co., Dayton Rubber Co., and Mohawk Rubber Co. followed with similar increases, and then The General Tire & Rubber Co. announced that as of July 6 its tire and tube prices would rise about the same amount. The Lee Rubber & Tire Corp. announced a 4½-6% increase at about the same time.

Rising costs of labor, raw materials, transportation, and other factors were given as reasons for the price advances.

L. A. McQueen, vice president of General Tire, in connection with the price rise announcement made by his company stated:

"This increase is due to the higher cost of doing business. The total cost has gone up while our volume of sales and profits are down measurably over last year."

This view was confirmed in Standard & Poor's "Industry Survey on Tires and Rubber," dated June 25, in which it was reported that combined sales of eight rubber fabricators in the initial quarter of their 1948 fiscal years showed a year-to-year decline of 3.7%. Sales declines were accompanied by pressure on operating margins, with the result that the contraction in earnings was more severe.

In view of the expected lower sales and narrower spreads, declines in net profits before reserves from near-peak 1947 levels will apparently be fairly sizable in most cases. However, reserve charges may be reduced or eliminated, and, in any event, indications are that final earnings of well-situated companies will remain favorable and considerably above those which prevailed for many years prior to the war. Thus current dividend rates, which are extremely conservative relative to recent earnings and which provide liberal yields, may be maintained, this report concluded.

Prices of rubber products other than tires and tubes are also on the rise. Both General Cable Corp. and Rome Cable Corp. announced price increases during the latter part of June. The increase for General Cable amounted to about 5% on its principal wire and cable products and ranged up to 13% on individual items. The company explained that the present increase in prices is the result of higher wages, together with substantial increases in the costs of freight, fuel, insulating paper, clerical salaries, supplies, and other items. General Cable granted its workers an 8% wage increase effective July 1.

"Much as we deplore it, we cannot continue to operate at present selling prices," the company said in a telegram to its district and branch offices.

On July 14, U. S. Rubber announced that prices of electrical wire and cable would be increased immediately by 6-13% to offset rising costs of labor and ma-

terials. Copper building wire will go up 13%; aluminum building wire with braided cover, 7%; aluminum building wire with neoprene cover, 13%; and portable cords, 6%.

A few days later Phelps Dodge Copper Products Corp. announced 5-13% price advances for its copper wire and cable products. The company's prices for bare, weatherproof, and Habirlene wires and cables advanced about 7½%; Habirshaw mold cured cords and cables, 6%; building wires and cables, about 13%; and other cords, approximately 10%.

#### Domestic Production Rate High

Higher costs and higher prices have not, as yet, caused much reduction in the production rate in the rubber industry. According to statements in the *Wall Street Journal* on June 29 by various rubber company executives, production rates are high and going higher, particularly in the mechanical goods branch of the industry.

J. H. Hayden, vice president of Hewitt-Robins, Inc., stated that his company's production of molded rubber goods is 10 times that of 1941. Hewitt-Robins rubber products go into the dairy, chemical, pipe, industrial truck, and automotive industries.

H. D. Foster, manager of Goodyear's mechanical goods division, reported that sales for the first half of 1948 are running 20% ahead of those in 1947 and added that sales last year, in turn, were 20% ahead of sales in 1946.

Howard M. Dodge, general manager of General Tire's mechanical goods division, said that his company's 1948 production will be 10% ahead of last year's.

The increase in business has called for plant expansions. U. S. Rubber has completed a huge new plant in Fort Wayne, Ind., which will concentrate largely on rubber-to-metal products. Goodyear has expanded its production from Akron to St. Mary's, O., Muncie, Ind., Lincoln, Neb., and New Bedford, Mass. General Tire, which entered the mechanical goods field in 1936, expanded to Wabash, Ind., before the war and later to Logansport, Ind.

E. F. Tomlinson, general manager of the Goodrich industrial products division, declared that in addition to the growing requirements of rubber-lined equipment for the chemical industry, one of the biggest coming fields in industrial rubber goods is rubber thread.

In the tire and tube field The Rubber Manufacturers Association, Inc., in its regular monthly report, stated that production of passenger-car casings during May was 5,719,740 units, an increase of 6.5% over April figures. Shipments of passenger-car casings dropped 12.7%, however, with a resulting inventory increase of 6.6%. May production of truck and bus casings was 1,211,053 units, 0.8% above the April total. Truck tire shipments declined from 1,186,940 units in April to 1,144,771 units in May; while inventories increased to 2,162,669 units. Automotive tube production and shipments followed the same general trend as casings.

In May, total new rubber consumption in the United States increased to 87,665 long tons, as compared with 85,248 tons in April, according to preliminary figures of the Office of Domestic Commerce, United States Department of Commerce.

In the first five months of 1948 new rubber consumption totaled 453,143 tons, a decline of 6.9% from the 486,875 tons used in the corresponding period of 1947.

Consumption of natural rubber during May amounted to 52,277 tons and included

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1,865 tons of latex. Synthetic rubber consumption reached 35,388 tons, consisting of 27,685 tons of GR-S, 4,617 tons of Butyl, 2,513 tons of neoprene, and 573 tons of nitrile type rubbers.

Consumption of GR-S amounted to 34.6% of the total GR-S plus natural in May, unchanged from the April percentage. The ratio of GR-S to total new rubber, however, increased slightly over April, as did the ratio of natural rubber and the nitrile types. The ratios of Butyl, neoprene, and reclaimed rubber declined.

May imports of natural rubber at 40,544 long tons showed little change from the April figure of 40,747 tons. Since consumption exceeded imports by more than 12,000 tons, stocks again declined sharply.

Synthetic rubber production totaled 42,866 long tons in May, against 40,846 tons in April, and consisted of 35,626 tons of GR-S, 3,727 tons of Butyl, 2,949 tons of neoprene, and 564 tons of nitrile type rubbers.

Stocks available to industry at the end of May follow: natural, 112,879 long tons (including 9,803 long tons, dry weight of latex); GR-S, 65,265; Butyl, 12,578; neoprene, 5,840; and nitrile types, 2,261 long tons.

Preliminary estimates of June rubber consumption, issued by RMA, show total rubber consumption amounting to 95,628 tons in June, a rise of 9% over May figures. Natural rubber consumed was estimated at 56,065 tons, up 7.5% over May. Total synthetic rubber consumption was estimated at 39,563 tons, up 11.8% from May, and consisted of 30,740 tons GR-S, 2,792 tons neoprene, 5,360 tons Butyl, and 671 tons nitrile types.

With these estimated June figures, rubber consumption for the first half of 1948 totaled 548,771 tons, 4% under the corresponding 1947 period. During the first six months of 1948, 322,588 tons of natural rubber and 226,183 tons of synthetic rubber were consumed; the latter consisted of 177,058 tons GR-S, 16,702 tons neoprene, 28,970 tons Butyl, and 3,453 tons nitrile types.

#### Estimated World Rubber Output and Consumption

New estimates of world production of natural rubber and the domestic consumption requirements of natural and synthetic rubbers for the calendar year 1948 were announced July 9 by Earl W. Glenn, Rubber Division, ODC.

The new estimate of 1948 world production of natural rubber is placed at from 1,450,000 to 1,500,000 long tons. The previously accepted estimate by the International Rubber Study Group had been 1,391,000 long tons. The possibility of increased output of natural rubber in the world in 1948 of from 59,000-109,000 long tons, depending on social, political, and economic developments in the rubber producing areas of Malaya, Indonesia, and elsewhere, is therefore recognized.

GR-S is currently being produced at a rate of about 34,000 long tons a month, or 408,000 long tons a year. Butyl, neoprene, and other synthetics are being produced at a rate that will provide an additional 100,000 long tons. It would appear that Canada may produce about 30,000 long tons of all types of synthetic rubber in 1948. Therefore the total world supply of new rubber for 1948 will be in the vicinity of two million long tons.

After consultation with representatives of the rubber manufacturing industry, the new domestic rubber consumption requirements have been estimated at 1,050,000

long tons for 1948, an increase of 82,000 long tons from the previous official estimate of 968,000 long tons.

Foreign demand for natural and synthetic rubber is now expected to be 825,000 long tons, which leaves approximately 1,175,000 long tons of new rubber available to the United States. This total, plus ample supplies of reclaimed rubber, should satisfy the programmed requirements of the strategic stockpile as well as the needs of the domestic rubber goods manufacturing industry, on the basis of synthetic rubber and reclaimed rubber being consumed at a high rate during the remainder of 1948, Mr. Glenn said.

Statistics on the world rubber position at the end of May have been issued by the Rubber Study Group. Production of natural rubber is given at 117,500 long tons in May and 592,500 tons for the first five months of 1948; while consumption of natural rubber totaled 107,500 long tons in May and 552,500 tons for the period January-May. Stocks of natural rubber at the end of May were as follows: in producing areas, 220,000 long tons; in consuming areas, 375,000 long tons; at sea, 230,000 long tons; and total, 825,000 long tons, a decline of 25,000 tons from total stocks at the start of the year.

World synthetic-rubber production is given as 45,000 long tons in May and 225,000 long tons for the first five months of 1948. Consumption of synthetic rubber was 37,500 long tons in May and 202,000 tons for the period January 31-May 31. Stocks of synthetic rubber at the end of May were 97,500 long tons, an increase of 20,000 tons since the first of the year.

The American rubber industry and rubber dealers took 201,259 long tons or 42% of total natural crude rubber shipments of 479,287 long tons out of Singapore and the Malayan Union in the first half of 1948, according to Commodity Exchange, Inc. This percentage represents a decline from American takings of 44.6% of total shipments in the first half of 1947.

Singapore and Malayan Union shipments in June were 87,368 long tons, consisting of 83,386 tons dry rubber and 3,982 tons latex, as compared with 88,867 tons in May. June shipments were the second largest for any month thus far this year, but takings by the United States were only 35,703 long tons, or 40.9% of total shipments from Malaya.

Stocks of crude rubber and latex in all hands in Malaya at the end of June amounted to 140,747 long tons, practically unchanged from stocks on hand at the end of May.

Rubber production in Malaya in June amounted to 60,594 long tons, a sharp advance from the 49,607 tons produced in May. Imports totaled 3,881 long tons in June, as compared with 3,065 tons in May.

## Management-Labor Relations

Higher costs, particularly labor costs, which have kept the Pharis Tire & Rubber Co., Newark, O., closed since May 1 may result in the closing of this plant for an indefinite period. The management of this company, which normally employs 1,200 persons, has been trying since May 1 to induce the URWA union to accept a new average wage rate of \$1.62 an hour instead of the previous \$1.74 average. The

employees have been working 30 hours a week.

"We simply cannot compete with the sort of labor contract we had," Furber Marshall, president of the company said. "It was costing us more to make tires than we could get for them."

Mr. Marshall described the \$1.74 rate as "the highest in the industry, to the best of my knowledge."

In Akron, H. R. Lloyd, vice president of the URWA, declared that members of the Newark local union had voted three times on the company's proposal and turned it down each time. The company's offer would have meant a plant-wide cut amounting to 10%, Mr. Lloyd explained, and would have wiped out all gains made in collective bargaining for the past 13 years. Mr. Lloyd added that Pharis' 1947 financial statement showed profits were up about 50% over prewar figures.

At a meeting of the Pharis board of directors in New York on July 15 it was decided to continue negotiations with the union for a definite period of time as there were hopes that in the near future a solution would be found that would permit the plant to be reopened on a sound and profitable basis.

Representatives of the company, the union, and the federal labor conciliation service met on July 21 in Newark to find a solution to the dispute. The meeting ended without results, but further meetings are to be held.

Seiberling Rubber Co. signed an agreement on July 18 with URWA Local 18, granting an 11c hourly wage increase to its 1,600 production workers. The raise, effective July 5, followed the industry's new wage pattern.

The General Tire & Rubber Co. began negotiations with the union on July 12 for a uniform contract covering wages and working conditions for the company's plants in Akron, O., and Waco, Tex. An agreement was reached on July 28 granting an 11c hourly wage increase.

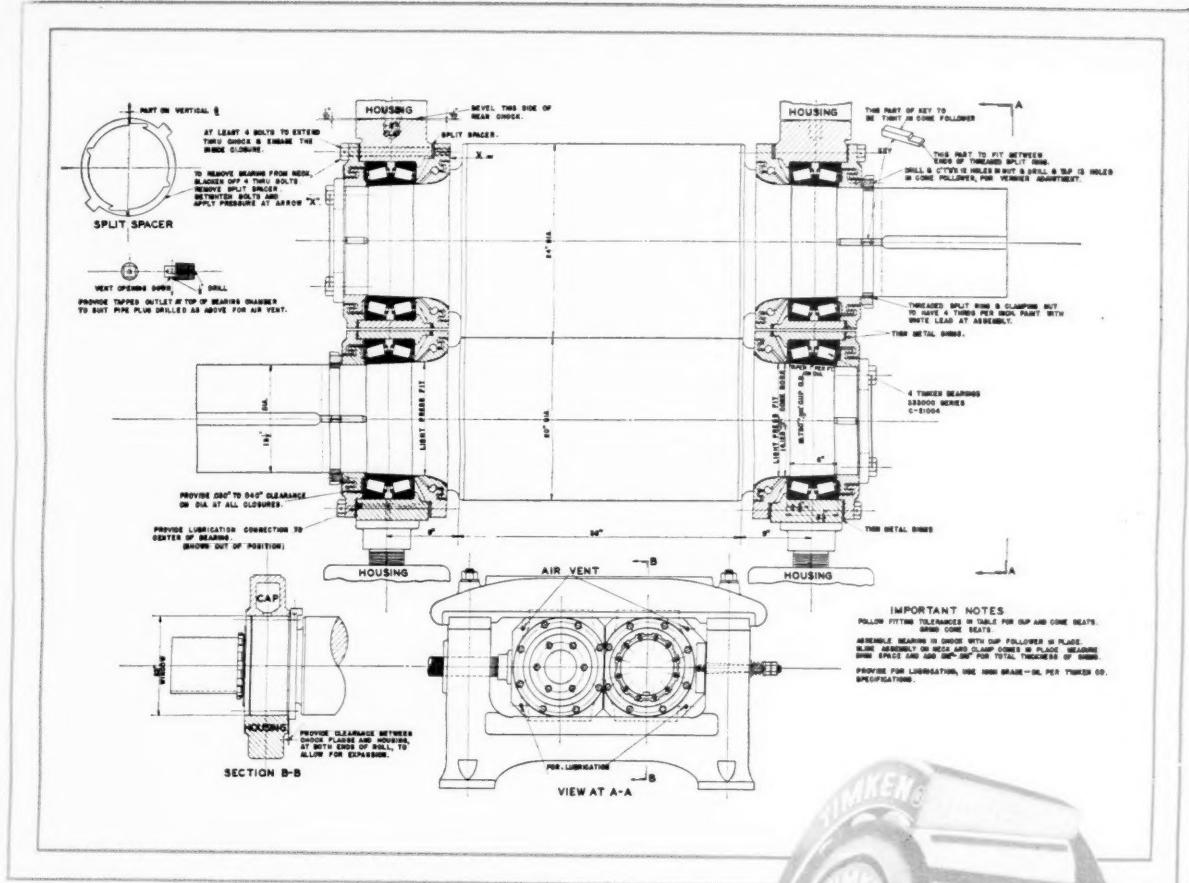
Kelly-Springfield Tire Co., Cumberland, Md., reached an agreement with union Local 26 late in July calling for an 11c increase, retroactive to July 11, for the company's more than 2,000 workers and a three-week vacation for employees having 15 or more years of service.

Members of URWA Local 58 voted on July 18 to continue their strike against the Sun Rubber Co., Barberton, O., until granted a union shop contract. Company and union, however, are still negotiating.

An offer by Midwest Rubber Reclaiming Co. of an 11c raise retroactive to June 14 tied to a two-year contract was voted down by members of union Local 77 at the company's Barberton, O., plant. The striking employees are demanding a 19c raise, severance pay, one-year contract, union shop, three weeks vacation for those with 10 years' service, and an improved insurance plan to be paid for by the company.

Mohawk Rubber Co., Akron, O., reported that truck tire production was back to normal on July 23 as 60 tire builders ended their two-day work stoppage. The dispute was over a new rate posted by the company and protested by the workers. The company said that the union agreed to work under the new rates during a trial period.

The Firestone Tire & Rubber Co. suffered a 24-hour work stoppage by maintenance men at its Akron Plants 1 and 2 on July 19, which also affected several thousand production workers. The tie-up came when maintenance crews objected to a change in the weekly work schedule.



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# EASTERN AND SOUTHERN

## Adds to Tires Line

Pennsylvania Rubber Co., Jeannette, Pa., has added an entirely new range of lower priced tires to its line. Named Keystone Deluxe, the line is the most modern and most complete lower priced line available today, according to R. B. Cave, vice president in charge of sales. Consisting of 10 sizes, the Keystone tire enjoys the most varied of size ranges in its field. The new tire, featuring a modern seven-rib tread design, is claimed to be comparable to many so-called 100-level lines. New molding equipment was purchased by the company to insure the latest styling in the tires.

Pennsylvania recently announced the addition of a complete range of farm service tires to its line. Featuring the T Grip rear tractor tire, the new line offers tires for every farm need, including both multiple-rib and single-rib tractor tires, rib implement tires, and the Pennsylvania V.C. cleat tire.

The company claims that its new T Grip rear tractor tire has superior traction and wearing qualities. The wider, deeper, traction bars give maximum traction; while the open center means better cleaning. It is so designed that three of the large traction bars make for easier riding and longer wear.

Interest in Pennsylvania Rubber tires was sparked on July 1 when the company's unconditional road hazard guarantee became effective. Under the new warranty dealers are now at liberty to guarantee all lines of Pennsylvania tires against damage occurring from normal road hazards up to 18 months, President Howard Jordan announced. Dealers are authorized to replace a damaged tire with a new one, charging the customer only for the time the old one was in use. Normal road hazards include bad roads, striking curbs, running over rocks, or similar mishaps which make a tire unsafe for driving. Under the arrangement Pennsylvania passenger tires are guaranteed from nine to 18 months; truck tires for six months; and tractor tires for 24 months. In addition to the tire industry's standard lifetime guarantee against defects in workmanship and materials, the new plan enhances the elasticity of tire insurance to consumers since it features on-the-spot adjustments by dealers.

Robert H. Taylor has been signed as territory salesman for three western states by Pennsylvania Rubber. A newcomer to the rubber industry, Mr. Taylor will work under District Manager A. R. Peck, of the Los Angeles office, and will cover Washington, northern Idaho, and Montana.

**Chemical Pump & Equipment Corp.**, 75 West St., New York 6, N. Y., has been formed to represent manufacturers specializing in chemical processing equipment. The territory covered by the corporation is New York State east of Rochester and western Connecticut. Officers are Robert T. Sheen, president; John W. Welker, vice president; Paul C. Flucke, secretary; John J. Smith, treasurer. Personnel includes A. W. Lubbers and Ted J. Zeller, sales engineers, and Robert Cohen, office manager.

## Opens New Laboratory



Frederic A. C. Wardenburg

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., opened a new laboratory, devoted to research and development work in the field of coated fabrics and allied products, in Newburgh, N. Y., on July 1. The three-story building of reinforced concrete and brick, occupying an area of 128 by 51 feet, contains the most modern equipment for the development and testing of coated fabrics and sheetings under all types of conditions. Directed by R. E. Thomas, the laboratory is part of the chemical division of the company's fabrics and finishes department. The new building is on the corner of Du Pont Ave. and Thompson St. on the property of the company's Newburgh plant, which manufactures Fabrikoid pyroxylin-coated fabrics, Fabrilite vinyl resin-coated fabrics, Tontine pyroxylin-impregnated window shade fabric, bookbinding materials, and other coated and impregnated fabrics and sheetings for many industrial uses.

Frederic A. C. Wardenburg, manager of du Pont's European office in London, has been made director of sales of the pigments department in Wilmington. He succeeds D. H. Dawson, whose promotion from director of sales to assistant general manager, was recently announced. Charles J. Harrington, technical representative in the London office, becomes manager of that office.

Mr. Wardenburg has been with the company 20 years. From 1928 to 1933 he was in the engineering department; then from 1933 to 1937 he was in the London office. On his return to Wilmington in 1937 he headed the foreign exchange section of the treasurer's department and later became manager of the banking and foreign exchange section. From March, 1942, to March, 1944, Mr. Wardenburg served as assistant treasurer of the Remington Arms Co. He returned to London in 1944, but later moved to the explosives department for work on the atomic energy program which du Pont undertook for the government. In May, 1945, he became manager of the European office.

Dr. Harrington has been with the company since 1933, starting work as a chemist in the Jackson Laboratory of the or-

ganic chemicals department. A year later he left for postgraduate work at Massachusetts Institute of Technology, returned to Jackson Laboratory in 1937, in 1940 was transferred to the industrial division of the engineering department, and the following year went to the Chambers Works as a supervisor of neoprene production. Later he went to the neoprene plant at Louisville, Ky. After a year, he was assigned to the Hanford, Wash., plant in the atomic energy program, where he served as a supervisor of production. In 1945 he returned to the Louisville plant as superintendent of the service division and in January, 1948, was transferred to London.

**Binney & Smith Co.**, 41 E. 42nd St., New York 17, N. Y., has added to its technical service department Francis W. Kenney, who will handle problems connected with the usage of carbon black and carbon black dispersions in paint, ink, paper, plastics, etc. Mr. Kenney, who is a graduate of the University of Colorado, with a B.A. degree in chemistry (1940), has been employed successively as an instructor, Montana State College; research chemist, heavy chemical industry, and development chemist, General Printing Ink Division, Sun Chemical Corp.; and research chemist at the San Jose Island Project, Panama, during his service in the U. S. Army's Chemical Corps.

John W. Snyder has been appointed technical director of the company. Mr. Snyder was graduated from Cornell University in 1927 with the degree of B. Chem. and since then has served in all branches of Binney & Smith research, development, and technical service work. He is also thoroughly familiar with all phases of the application of the wide range of carbons, both as to compounding and processing, as well as the testing and control of production.

**Hewitt-Robins, Inc.**, Buffalo, N. Y., rubber products and materials handling equipment manufacturer, announced on July 1 the occupancy of new executive and sales offices consisting of the entire 18th floor at 370 Lexington Ave., New York, N. Y. The office seating has been custom designed to make use of the company's new Restfoam cushioning and is believed to be the first office in the country to be equipped completely with the new foam latex material. In addition to being executive offices, the new location will serve as eastern sales offices for the Hewitt Rubber and Restfoam divisions, Buffalo, and Robins Conveyors and Engineers divisions, located at Passaic, N. J., and New York. Hewitt-Robins' executive offices were formerly located at 70 Pine St.

F. L. Murdock & Co., Tulsa, Okla., has been named to handle the Hewitt Rubber line as industrial and oil field distributor of hose, conveyor and transmission belting, and packing.

**The Glenn L. Martin Co.**, Baltimore 3, Md., has appointed Albert W. Fuhrman research chemist in the chemicals division laboratories, where he will assist in continuing research in the vinyls and allied fields. The company's chemicals plant, producing Marvinol VR-10 polyvinyl chloride-type resin, is at Painesville, O., and the division offices and laboratory are at 501 Preston St., Baltimore.

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## 6

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**Reichard-Coulston, Inc.**, 15 E. 26th St., New York, N. Y., recently elected to the presidency J. W. Bossert, who will also serve as treasurer of the company. He succeeds President J. W. Coulston. Mr. Bossert has spent his entire business career in the field of natural and synthetic iron oxide pigments, having started as a youngster with the old firm of F. A. Reichard, Inc.

**Raybestos-Manhattan, Inc.**, Manhattan Rubber Division, Passaic, N. J., has appointed A. L. Hawk assistant to the western district manager in Chicago, Ill. His previous post, manager of distributor sales, western district, goes to R. B. Hazard, who formerly represented the Raybestos Textile & Packing Division in the Minneapolis territory.

Manhattan has developed the new Condor Homo-Flex heavy-duty air hose for rugged service encountered in mining and quarry operations. The new product can also be used to advantage in other air services requiring a super-tough type of hose. The new hose is said to have an extra-strong tube compounded of Manhattan oil-proof Flexlastics, two braids of heavy strength member, and a thick abrasion-resistant oilproof Flexlastics cover, but to retain the flexibility which features the Condor Homo-Flex design. Three-quarter and one-inch inside diameter sizes are being made with working pressures of 350 and 300 pounds, respectively.

**Allied Asphalt & Mineral Corp.**, 217 Broadway, New York 7, N. Y., has appointed Wetherbee Chemical Co., 525 Washington Highway, Buffalo 21, N. Y., as sales and technical representative for the western New York area. Allied Asphalt, which has a plant in Dunellen, N. J., is a compounder of pitches, asphalts, waxes, and oils.

**Merrill Lynch, Pierce, Fenner & Beane**, New York, N. Y., has added to its organization, as manager of its hide and rubber department, Alexis Tatistcheff, principal economist with the Combined Raw Materials Board during the war and prior to that chief statistician of the Commodity Exchange, Inc.

**Thermoid Co.**, Trenton, N. J., has signed A. Ray MacPherson as manager of its industrial friction materials sales division, with headquarters in Detroit, Mich. He previously had been sales manager of Standeo Brake Lining Co., Houston, Tex., and prior to that had been with Raybestos-Manhattan, Inc., for many years in various capacities. For five years Mr. MacPherson manufactured and sold his own brake lining under the trade name of "Brake Friction."

**Hercules Powder Co.**, Wilmington, Del., to broaden the scope of its services to customers in industries using synthetic resins, has made two transfers in its synthetics department. Paul L. Lefebvre, district manager for synthetics in the Hercules Chicago office, has been sent to the home office in Wilmington, where he now is assistant manager of the department's market development division. J. Glenn Little, formerly assistant manager of the division, has taken up his new duties in the Chicago office, replacing Mr. Lefebvre.

## Hack with NSRB

William T. Hack has been appointed director of the newly created division of chemicals, rubber, and allied products of the National Security Resources Board, Washington, D. C. Chairman Arthur M. Hill announced recently. For the past two years Mr. Hack was a special assistant to the vice president of the Ethyl Corp. Besides he also has held responsible positions in the Federal Government, having served as assistant production manager of the synthetic rubber section of the Office of Rubber Reserve from August, 1945, to March, 1946, and as production manager of the butadiene-from-alcohol section of the same organization from 1942 to 1945. For six years previously he had served as chemical engineer with the Carbide Carbon & Chemical Corp., South Charles-ton, W. Va., where he participated in the improvement of processes and yields, and reduction of costs, in the manufacture of synthetic organic chemicals and plastics. Mr. Hack attended the Lawrenceville Academy, Princeton University (B. S., Ch. E., 1935), and Graduate School of Business Administration, Harvard University (1936). He is a member of the American Institute of Chemical Engineers and of the American Chemical Society.

## Changes at U. S. Rubber

United States Rubber Co., Rockefeller Center, New York 20, N. Y., has appointed Harold A. Shank manager of the aircraft tire department, with headquarters in Detroit, Mich. Mr. Shank joined the company in 1936 as a tire salesman at Kansas City, was appointed assistant district manager there in 1940, and three years later was transferred to Los Angeles to supervise airplane tire sales on the Pacific Coast.

Dwight B. Eldred has been named assistant sales manager of U. S. Tires division. He joined the company in 1941 as supervisor of associate dealer sales, was promoted to manager of this department in 1945, subsequently became manager of wholesale merchandising, responsible for sales activities with car dealers, and was appointed central divisional manager for U. S. Tires in Chicago in 1946. He will headquartered at the company's general offices in New York.

William H. Kneass has been made central divisional manager of the division, succeeding Mr. Eldred. Mr. Kneass joined the company as a salesman at Dallas in 1937; was transferred to New Orleans as district manager; in 1941 was assigned to the airplane tire department at Los Angeles; during the war was in charge of airplane fuel-cell production at the Los Angeles plant, and was subsequently made western divisional manager for U. S. Tires on the West Coast.

Edward Lebo has been made assistant director of public relations. He joined the company in 1944 after ten years as a newspaper reporter and editor and five years as sales representative for various firms.

Thomas H. Young, director of advertising, U. S. Rubber, has been made a director of the Audit Bureau of Circulation.

U. S. Rubber had an accident frequency rate of 5.57 disabling injuries per million man-hours in 1947. This figure may be compared with 1947 accident frequency

rates of 9.04 for the rubber industry and 13.26 for all industries. As for severity of injuries, U. S. Rubber had 0.53-day lost because of injuries per thousand man-hours in 1947, as compared with 0.70-day for the rubber industry as a whole and 1.23 days for all industries.

An electric heating pad to prevent accumulation of ice in water-contaminated gasoline has been developed by U. S. Rubber as a cold-weather aid for engines. The pads, made of the company's electrically conductive Uskon rubber, supply heat to a dehydrator produced by Erie Meter Systems, Inc., which removes water from fuel by a filtering process. The pads are wrapped around the filtering tank and the tank where the unwanted water is deposited and maintain a temperature of 38° F. for both the gasoline and the water. The heated dehydrator is particularly useful for airports in Alaska and other northern points where formation of ice in aircraft gasoline clogs fuel lines and puts engines out of commission. In warm weather the dehydrator is used without the heating pad.

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**Lee Tire & Rubber Co. of New York, Inc.**, a subsidiary of Lee Rubber & Tire Corp., Conshohocken, Pa., has named Anthony Lord, formerly advertising manager of American Can Co., sales promotion manager.

**The American Institute of Chemists**, 60 E. 42nd St., New York 17, N. Y., has appointed as councilors-at-large Roy H. Kienle, assistant director of research, Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., and Charles P. Neidig, in charge of market research on chemical products for Atlantic Refining Co., Philadelphia, Pa.

**United States Department of Commerce**, Washington D. C., in its desire to simplify, wherever possible, the procedure for submitting export license applications and to expedite their processing within the Office of International Trade, has established a procedure whereby related groups of non-Positive List commodities may be authorized for export to a single consignee in a single Group R destination under a single license. Details are covered in "Current Export Bulletin," No. 464, July 8, 1948, and among the products affected are natural rubber, allied gums, synthetic rubber, rubberized cloth, rubber footwear, rubber-soled canvas shoes, rubber soles, heels, top lift sheets, druggists' rubber sundries, rubber balloons, toys, and balls (except golf and tennis), bathing caps, rubber bands, rubber erasers (except pencil plugs), hard rubber goods, tires, casings, inner tubes, tire sundries and repair materials, rubber and friction tape (except medicated), rubber and balata belts and belting, rubber hose and tubing, packing, mats, matting, flooring, tiling, rubber thread, gutta percha manufacturers, latex or other forms of rubber, compounded or processed rubber, naval stores, cotton manufactures, synthetic fibers and manufactures, certain asbestos goods, batteries, synthetic resins, athletic and sporting goods and parts.

**Endicott-Johnson Corp.**, Johnson City, N. Y., recently leased 56,000 square feet of floor space in the former local plant of Remington Rand, to be used mainly for the storage of rubber footwear.

## LOW-VISCOSITY, POLYMERIC VINYL PLASTICIZER

# PARAPLEX G-50

**for plasticizing permanence, plus ease of handling**

The permanent plasticizing effect of a high-molecular weight polyester plus the simplicity of incorporation and handling of a monomeric-type plasticizer—these are the outstanding advantages of Paraplex G-50 as a modifier for polyvinyl chloride, polyvinyl acetate, nitrocellulose, and acrylic resins. In addition, the low viscosity of Paraplex G-50 makes it of particular interest in dispersion compounding for dipping, molding and extruding work.

### CHECK THESE ADVANTAGES

**PLASTICIZING PERMANENCE**—Paraplex G-50 stocks are outstanding in durability . . . retain their excellent physical properties over long and severe periods of usage.

**PROCESSING EASE**—For both calendering and extruding compounds, Paraplex G-50 stocks process easily—are notable for smoothness and high finish.

**FAST PIGMENT WETTING**—Paraplex G-50 is an excellent pigment grinding medium . . . gives better coverage, color uniformity, and pigment binding than monomeric-type plasticizers.

**NON-MIGRABILITY**—Paraplex G-50 does not migrate to the surface of vinyl films on aging . . . ends "lacquer lifting" problems.

**NON-EXTRACTABILITY**—Like Paraplex G-25 and G-40, Paraplex G-50 is insoluble in oils, fats, water, and aliphatic hydrocarbons—provides soft, flexible polyvinyl chloride compounds with high service resistance.

**FREEDOM FROM ODOR AND TASTE**—Compounds plasticized with Paraplex G-50 are eminently suitable for rainwear, packaging, tubing and other special applications where lack of odor and taste are important.

**ADAPTABILITY TO DISPERSION COMPOUNDING**—Free-flowing plastisols made with Paraplex G-50 show outstanding viscosity stability, and can be fluxed satisfactorily at temperatures somewhat higher than those used for monomeric-type plasticizers.



For full details on the characteristics and uses of Paraplex G-50, write for our latest bulletin. Our technical staff will be glad to answer any questions you may wish to ask—and to advise you concerning any application of Paraplex G-50 or its companion resins, Paraplex G-25 and G-40.

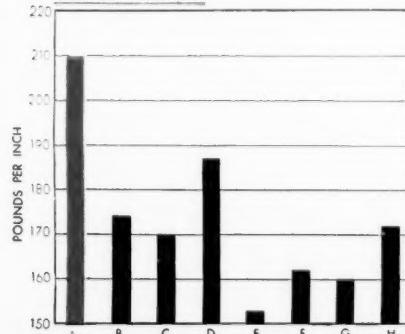
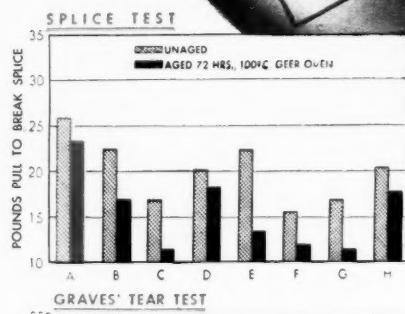
**THE RESINOUS PRODUCTS  
& CHEMICAL COMPANY**

WASHINGTON SQUARE, PHILADELPHIA 5, PA.





# For the Compounder A NEW DEVELOPMENT



"A" is a butyl inner tube manufactured by Cascade Rubber, Inc., Cuyahoga Falls, Ohio, using Vistac #1 as the plasticizer.

"B" through "H" are butyl rubber inner tubes manufactured by various rubber companies, presumably using the customary softeners.

Write for our new bulletin on "Vistac #1 in Butyl Inner Tubes."



## ADVANCE SOLVENTS & CHEMICAL Corporation

245 Fifth Avenue • New York 16, N. Y.



Fig. 3. One of the Laboratories of the Department of Technical Service

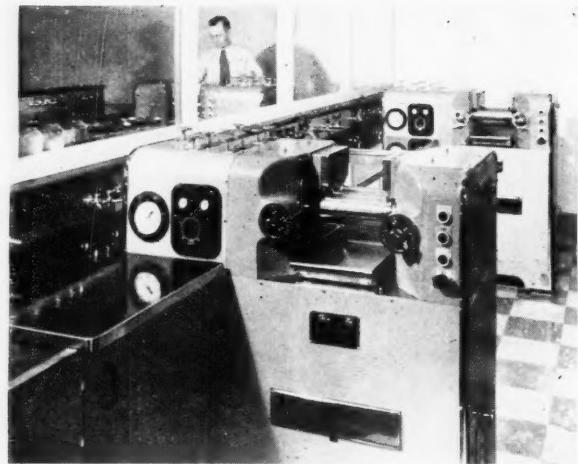


Fig. 4. Specially Designed Mills in the Department of Compounding Research

equipment are on the ground floor of the engineering building.

The chemical engineering research area extends into the main floor of the engineering building. Also on this floor are laboratories for physical research, including a compounding room, a plastics processing room, and a room for high-frequency heating and curing. This department is headed by Mr. Davies.

The third floor of the engineering building has more physical research and testing equipment, and the office of the director of chemical engineering research, Mr. Japs, is on this floor.

#### Personnel Promoted

Henry J. Zimmerman, general traffic manager of the Goodrich company since 1921, has been named assistant to the vice president and assigned to special administrative duties. Richard W. Corns succeeds Mr. Zimmerman as general traffic manager. Mr. Zimmerman, oldest employee in point of service now on the rolls of the company, joined it in 1900. Mr. Corns came to Goodrich in 1934, as a sales analyst and remained in that capacity until 1941, when he was transferred to the traffic department.

Charles H. Caldwell has been appointed sundries sales promotion manager at Goodrich. With the company's sales promotion departments since 1944, Mr. Caldwell has been handling sales promotion for the company's shoe products for the last 18 months and will continue in that capacity in addition to his new duties.

George J. Fischer has been named manager of national accounts of the industrial products sales division. He had been product manager in the division for the last several years, handling the sales of hose. James M. Flounders succeeds him in that capacity.

David M. Goodrich, chairman of the board, attended the fiftieth reunion of the Rough Riders Association of which he is president, in Prescott, Ariz., recently. More than 60 of the survivors of the charge up San Juan hill met in the Arizona town in which the 1st U. S. Volunteer Cavalry was formed a half century ago by Theodore Roosevelt.

Sheets of Goodrich's Armorite rubber, especially compounded to resist abrasion, are being used as dragnet chaffing gear by one of the large commercial fishing

companies operating new Seattle, Wash. Armorite sheets attached to the bottom of the tapered nets for 30 months are still in excellent condition. Tanned bullhide had previously been used in this service, but the Armorite sheets are said to give four times as long service. The sheets used are 84 inches long, 48 inches wide, and 3/16-inch thick.

**The General Tire & Rubber Co.,** Akron, has announced that the month of June was the biggest in replacement tire sales in its history, and July sales most likely will outstrip June. W. O'Neil reported to the company's board of directors at its regular July meeting.

"Sales in our top lines of tires, both in automobile and truck casings, were the greatest in the 33-year history of the company," Mr. O'Neil said. "We also have experienced a tremendous demand for our new puncture-sealing safety tube, a demand so great that our manufacturing departments have not yet been able to meet it."

The sales of our mechanical goods division at Wabash, Ind., have far exceeded expectations, necessitating expansion programs both in machinery as well as personnel," President O'Neil further reported.

Commenting on General's first six-month sales for the 1948 fiscal year, Mr. O'Neil said: "Although the last five years have been the biggest in our company's history, our sales of \$46,782,582.88 for the first six months of this year were in excess of our average sales for the same months in this high period. Our sales would have been even greater on our top lines of tires if we had been able to secure sufficient equipment in time to meet the increased demand for these tires."

**Dayton Chemical Products Laboratories, Inc.**, has moved its office, plant, and laboratories to West Alexandria, O.

**Diamond Alkali Co.**, Cleveland, has elected as treasurer Arthur W. Crossley, for the past three years assistant general manager of the Potomac Electric Power Co. He succeeds Wm. H. Evans who, in addition to his duties as general manager of Diamond's six silicate producing plants, had been acting treasurer since March 2.

**The Mansfield Tire & Rubber Co.,** Mansfield, recently created four new divisions to direct field sales operations. Elevated to head the divisions as division managers were four district sales managers, all veterans in the company's sales organization. Walter J. Gray, with headquarters at Oakland, Calif., heads the western division, which embraces California, Oregon, Washington, Nevada, Colorado, New Mexico, Arizona, Utah, Idaho, Wyoming, Montana, and El Paso, Tex. In charge of the southern division is R. K. Houston headquartered at Bay Springs, Miss., whose territory includes Texas (except El Paso), Louisiana, Mississippi, Arkansas, Oklahoma, Tennessee, Alabama, Georgia, Florida, and North and South Carolina. Heading the midwestern division, with headquarters in Mansfield, covering Indiana, Illinois, Missouri, Kansas, Iowa, Nebraska, Wisconsin, Minnesota, North and South Dakota, and the northern peninsula of Michigan, is Carl B. Gibson. The eastern division, with headquarters also in Mansfield, is under F. David Boals and comprises the balance of the State of Michigan, Ohio, Kentucky, West Virginia, Virginia, Pennsylvania, Delaware, Maryland, the District of Columbia, New Jersey, New York, Rhode Island, Connecticut, Massachusetts, New Hampshire, Vermont, and Maine.

**Ohio Manufacturers' Association** met last month in Youngstown for election of officers. Among those named were R. H. Miner, of Goodyear Tire & Rubber Co., a vice president, and W. Robert Timken, vice president, The Timken Roller Bearing Co., a trustee.

**Huffman Mfg. Co.**, Dayton, recently held a two-day conference which attracted 43 executives as representatives of 29 companies which supply 65% of the component parts of bicycles by Huffman. Tire men present were: Furber Marshall, president, E. A. Moller, sales manager, and Paul M. Gausaulus, bicycle sales manager, all of Pharis Tire & Rubber Co., Newark; Noel M. Lanham, manager of the cycle tire sales department, Francis A. Leving, bicycle tire salesman, and Paul C. Kress, industrial engineer, all from United States Rubber Co., Indianapolis, Ind.; and Thomas F. Judge, assistant manager of bicycle tire sales, Goodyear Tire & Rubber Co., Akron.



Test No. 8367—LPG from the Barrett Rubber Research Laboratory

**RECIPE  
FOR  
BLACK EXTRUDED and MOLDED  
GR-S COMPOUND  
of 80 Shore A Durometer Hardness**

RECIPE	WEIGHT BASIS
GR-S Standard . . . . .	100.0
BRS 700 Rubber Softener . . . . .	30.0
Channel Black (EPC) . . . . .	50.0
Furnace Black (MT) . . . . .	100.0
Zinc Oxide . . . . .	3.0
Stearic Acid . . . . .	2.0
"BLE" 25 . . . . .	1.0
Sulfur . . . . .	2.0
"Santocure" . . . . .	1.0
<b>TOTAL</b> . . . . .	<b>289.0</b>
Mooney Viscosity (Large Rotor) 4 minutes at 212° F. . . . .	75
Specific Gravity . . . . .	1.30
Rubber Hydrocarbon, % by Wt. . . . .	34.6
Rubber Hydrocarbon, % by Vol. . . . .	48.6

Mooney Scorch Test Data at 250° F. (Small Rotor)	
MINUTES	VISCOOSITY
1	35
5	33
10	35
15	42
20	56

**Cure at 316° F. (70 lb.)—10 Minutes**

Tension and Hardness Data:	Unaged	Aged 24 Hrs. at 100° C.
Stress (@ 300%, psi) . . . . .	1150	—
Stress (@ 500%, psi) . . . . .	1300	—
Tensile, psi. . . . .	1450	1550
Elongation, % . . . . .	600	260
Permanent Set, % . . . . .	26	9
Hardness, Shore A . . . . .	80	95
Tear Resistance, Angle . . . . .	285	135
Crack-Growth Resistance, Ross, Kilocycles per 500% Crack Growth . . . . .	—	198.5
Abrasion Resistance, duPont cc. Loss per hp-hr. . . . .	475	390
Compression Set, 40% Constant Deflection, % . . . . .	53.3	—
Impact Resilience, Goodyear-Healey Rebound Pendulum, % Rebound . . . . .	31.1	39.4

**THE SUPERIOR SOFTENING** and extending characteristics of Barrett\* BRS 700 rubber softener will assist the compounder in the design of molded and extruded stocks for the production of quality products at low cost.

**BRS 700 RUBBER SOFTENER** has a mild accelerating effect which promotes short curing cycles and yields relatively resilient vulcanizates with tight cures. The compound may be safely processed, as illustrated by the Mooney Scorch Test Data.

**BRS 700 RUBBER SOFTENER** permits the use of relatively high filler concentrations, yielding compounds with low shrinkage and excellent processability, and insuring smooth and rapid extruding properties. In automotive and aviation parts, in tubing and belting, and in other mechanical items, the use of BRS 700 rubber softener provides economy with quality.



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ALLIED CHEMICAL & DYE CORPORATION  
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\*Reg. U. S. Pat. Off.

## Moves Plastics Company

Roger S. Firestone, president of Firestone Plastics Co., and his staff moved last month to the Firestone Tire & Rubber Co. plant at Pottstown, Pa., where all plastic activity, including sales, will be integrated. Development and production have been located there, together with one of Firestone's largest tire production units.

All production activities at Pottstown will be under the direction of E. T. Handley, formerly in charge of foreign plant manufacturing activities and wartime head of the company's extensive synthetic rubber production program. J. C. Blue, formerly factory manager at Pottstown, becomes factory manager of the Firestone plant at Des Moines, Iowa. Ward B. Earley will continue in charge of tire manufacturing at Pottstown, and Henry Koehler will head plastics production. Frank J. Grotten remains as director of the plastic development laboratories. Harold W. Hooper, formerly comptroller of Firestone Aircraft, has been appointed comptroller at Pottstown.

Elmer H. French, general sales manager of the plastics company, is moving from Akron to Pottstown. Other members of the sales staff who will have headquarters at Pottstown are: Kenneth L. Edgar, manager of Velon film sales; E. A. Ryder, manager of Velon flex sales; Erle M. Brizard, manager of Velon filament sales, and M. D. Price, manager of Velon screening sales.

Roger Firestone, one of the five Firestone brothers, all directors and active in the business founded by their father, joined the company following his graduation from Princeton in 1935. Later he became president of Firestone Rubber & Latex Products Co., Fall River, Mass. A few months after the United States entered the war, he was commissioned in the Naval Reserve and was on active duty in the Bureau of Aeronautics and in the office of Chief of Naval Operations. He was relieved of active duty with the rank of lieutenant commander in September, 1945. He then became president of Firestone Aircraft Co. and manager of the new products department of the parent company. When the plastics company was organized in September, 1947, he became its president.

### New Zealand Plant Operating

"First tires ever to be made in New Zealand now are being produced by Firestone in its recently completed, straight-line production factory at Papamui, near Christchurch," Harvey S. Firestone, Jr., chairman of The Firestone Tire & Rubber Co., Akron, announced last month. According to Mr. Firestone, "Opening of this new tire and tube factory completes the latest link in the company's round-the-world manufacturing operations. The Firestone tire factory in New Zealand now can supply directly the tire needs of motorists in that country as well as in the entire Southwest Pacific area."



Architect's Drawing of New Plant of Firestone Tire & Rubber Co., Papamui, New Zealand

The New Zealand plant was completed in June. American production supervisors are training a staff of New Zealanders to handle all production problems, and the tire output of the plant is being increased daily.

Other foreign manufacturing plants of Firestone are in Canada, England, Spain, Switzerland, South Africa, India, Brazil, Sweden, and Argentina.

## Forms Chemical Division

The Goodyear Tire & Rubber Co., Akron, recently established a chemical division to handle the company's rapidly expanding manufacture and sales of synthetic rubber and its combination with other raw chemicals. This new division has been created from the plastics and coatings department of the previously called chemical products division, now known as the general products division. Creation of the chemical division, it was explained, makes it possible for Goodyear to offer specialized technical facilities in research and development to manufacturers who use Goodyear chemicals in their end-products.

Herman R. Thies, manager of the plastics and coatings department, becomes head of the new division; while W. A. Aiken, formerly assistant department manager, assumes a similar position in the chemical division. All personnel of the plastics and coatings department, moreover, are now members of the chemical division staff.

The general products division, headed by C. P. Joslyn, embraces Pliofilm, Airfoam, builders' supplies and flooring, and plastics department.

Robert E. Workman, chemical engineer for Goodyear, has been named a special representative of the chemicals division and will be stationed at St. Louis. He joined the company in 1942, working first as a junior research chemist and several years later as an engineer of senior rank in the specialized chemical organization. For the past year and a half Mr. Workman has been assigned to Mr. Thies' operations.

Mr. Thies, later announced the appointment of Raymond S. Earhart as operating manager, and Robert S. Sanders as manager of Pliobond sales. Mr. Earhart joined Goodyear in 1940 as a store employee at Dayton, O., later transferring to Huntington, W. Va. He served during the war in the infantry and upon his return from service was named to the sales staff of the plastics and coatings department. Mr. Sanders, a 25-year veteran with the company, served the plastics and coatings department as office manager from 1943 until 1946, when he was assigned to technical sales.

Martin B. Uhrich has been made engineering manager of the Los Angeles plant. This is his second assignment there. He was engineering manager from 1930 to

1940. Mr. Uhrich, whose latest position was as analyst of equipment maintenance at the Akron plant, has been with Goodyear nearly 30 years.

Appointment of two Goodyear men to overseas posts was announced recently by G. K. Hinshaw, vice president and production manager of foreign operations.

Melvin A. Wilson becomes development manager of the Goodyear plant at Wolverhampton, England. A graduate of the University of Cincinnati, he has been employed by Goodyear, 14 years.

Harris Hart goes to Norrkoping, Sweden, as technical service manager. A graduate of Iowa State College, Mr. Hart has been with the company a decade.

Robert R. Kidd has been named chief chemist at Goodyear's plant in Buitenzorg, Java. With Goodyear since 1943, Mr. Kidd in his previous position was chief chemist at the plant in Topeka, Kan.

Vernon H. Jones, manager of Goodyear's store planning and display department, received a citation June 30 from the American Marketing Association for "setting a pattern for coordinating the merchandising efforts of manufacturer and retailer." The citation was presented at the third annual award luncheon of the A.M.A. at the Hotel Commodore, New York, N. Y., when Mr. Jones was one of nine persons similarly honored. Goodyearites attending the meeting were J. E. Mayl, vice president of the tire sales division; H. G. Harper, manager of associated merchandise; F. W. McConky, Jr., manager of the northeastern division; and R. E. Davis, manager of sales research.

Addition of four new sizes of red bicycle tubes has been announced by Goodyear: 20 x 2.125, 24 x 2.125, 26 x 1.375 heavy-duty, and 26 x 2.125 puncture resistant, the latter containing extra rubber under the tread to provide greater protection. Together with the size 26 x 2.125 heavy-duty red tube previously announced by the company, the new units now make available to the public Goodyear-built red tubes in all popular sizes. In addition a complete line of black tubes is also offered.

Manufacture of the red tube was discontinued soon after start of World War II as an emergency measure.

A new V-belt designed especially for portable power saws used in pulpwood felling operations and in clearing underbrush has been developed by Goodyear's mechanical goods division. Named the Pulpwood Saw V-Belt, the new product has been tested by manufacturers and users of power saws and is said to give an operating life up to 100% longer than conventional belts. According to J. F. Taylor, manager of the V-belt department, the new belt contains high-tensile rayon cord which has sufficient "give" to carry all but the heaviest underbrush through the saw pulleys without breaking, thus assuring fewer breakdowns and longer belt life. Other features of the new belt are an improved wear-resistant envelop and high-tension load carrying members designed to withstand severe friction heat and shock.

J. Carlton Wood, technical sales representative of the R. T. Vanderbilt Co., New York, N. Y., suffered severe injuries, including a broken collar bone, when he fell from the roof of his home in Akron, O., about the middle of July. He is in St. Thomas Hospital, 444 N. Main St., Akron, and is expected to remain there for several weeks.



## Great Day for Grandma

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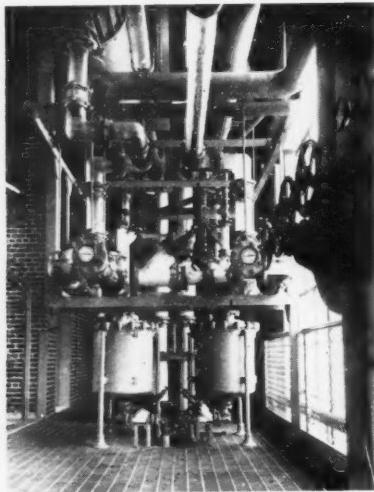
**FOR HELP** on any solvents problems you may have... call on your Esso Solvents sales representative.



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**ESSO STANDARD OIL COMPANY OF PENNSYLVANIA**  
Philadelphia, Pa.

## NEW ENGLAND



**Reaction Kettles in the Hydrolysis Building of the New G-E Silicone Plant**

### G-E Advances Several

General Electric Co., Pittsfield, Mass., has appointed George P. Lehmann to the personal staff, with duties as assigned, of Vice President Zay Jeffries. Mr. Lehmann came to the company in 1935 as a student engineer. He subsequently served as a member of the high-voltage laboratory of the Pittsfield apparatus works; as assistant to the chief engineer of the plastics division (1939); and as plant engineer of the company's Meriden, Conn., works (October, 1940). During the war he was a colonel in the air force. Upon his return to civilian life he was made, in 1946, assistant division manager of the G-E plastics division and in January, 1947, manager of the division, which has plants in Meriden, Pittsfield, Taunton, Mass., Scranton, Pa., Coshocton, O., and Decatur, Ill.

Robert L. Gibson succeeds Mr. Lehmann in the last-named capacity. Mr. Gibson, who has been manager of the chemical department's personnel division as well as of its advertising and sales promotion division, first entered the employ of G-E in 1925.

Harold F. Smiddy has been appointed general manager of the chemical department, with headquarters in Pittsfield. Since March, Mr. Smiddy had been on the staff of G-E President Charles E. Wilson.

Raymond G. Schieles has been made buyer for the resin and insulation materials division. He previously had been a buyer in the purchasing department of the company's general office, Schenectady, N. Y. He has been with General Electric since 1937.

### New G-E Silicone Plant

A new multi-million dollar chemical plant for the manufacture of silicone materials has been completed in Waterford, N. Y., by the G-E chemical department. In partial operation for about a year, the new plant is now ready to produce the silicones at full capacity to meet the ever-increasing demand. Consisting of six buildings and a chemical tank farm on a 15-acre tract, the plant currently employs ap-

proximately 150 persons and may employ even more when full production is attained.

It was also revealed that the major output of G-E's silicones today is in the form of rubber, oils, and the bouncing putty which has found extensive use as the center of golf balls made by United States Rubber Co. The silicone rubber is being used primarily as gasketing in high-temperature industrial applications; while the silicone oils are finding extensive use as mold release agents in the manufacture of automobile tires.

### Elections at General Latex

General Latex & Chemical Corp., 606 Main St., Cambridge 39, Mass., held an election of officers, following the recent death of President Harvey J. Elwell. His successor is Kenneth B. Osborn, formerly vice president. Other officers include Chester A. Brown, vice president in charge of production; Henry B. Townsend, vice president in charge of laboratories; Warren MacPherson, treasurer; Frederick L. Patton, assistant treasurer and clerk. Also elected were the following directors: Arthur B. Newhall, chairman, Lawrence Clayton, W. Craig Steele, and Messrs. Brown, MacPherson, and Osborn.

Mr. Newhall who succeeds the late H. Stuart Hotchkiss, is treasurer of Dennison Mfg. Co. and of The Cambridge Rubber Co. and also is a director of the Second National Bank of Boston and of the Framingham National Bank. Mr. MacPherson is president of Cambridge Rubber and of the Cannon Shoe Co.; while Mr. Clayton is a member of the board of governors of the Federal Reserve System. Mr. Steele is president and treasurer of General Latex & Chemicals (Canada), Ltd.

**Charles F. Connor & Co., Inc.**, crude rubber importer and dealer, 110 State St., Boston 9, Mass., has been appointed export manager for Malrex Chemical Co. and Bunatak Chemical Co., both of Malden, Mass. These firms manufacture chemicals for the rubber, the paper, and the textile industries, and Mr. Connor reports that their products are meeting with approval of overseas buyers.

**Davidson Rubber Co.**, Boston, Mass., has appointed Joseph G. Seck, assistant to the general manager in charge of sales promotion. This is part of Davidson's new program to offer merchandising assistance to wholesale and retail drug outlets. Mr. Seck was formerly with McKesson & Robbins, Inc., manufacturing division, and The Rubber Manufacturers Association, Inc.

## MIDWEST

**Link-Belt Co.**, 307 N. Michigan Ave., Chicago 1, Ill., has appointed Crozier S. Wileman district sales manager at Wilkes-Barre, Pa., to succeed A. C. Williams, who has retired after 43 years of service. Mr. Wileman entered the employ of the Link-Belt Philadelphia plant in October, 1924, in the capacity of tracer and detailer in the engineering department; was transferred to the engineering standards division in 1926 and to sewage treatment plant engineering in 1928; to the sales department in July, 1931, when he moved to Chicago as district sales engineer specializing on the application of sewage and water treatment plant equipment in central division territory; to the Cleveland office in 1939 to serve as district sales engineer for all Link-Belt products, and to the Philadelphia district sales office in 1945 in a similar capacity. He will be assisted at Wilkes-Barre by Alton H. Ziegler, also recently transferred from the Philadelphia district sales office.

**The Dow Chemical Co.**, Midland, Mich., recently promoted F. C. Peterson to the position of production manager of the cellulose products division. He steps up from the assistant management of the division to replace W. R. Collings, vice president and general manager of Dow Corning Corp. Dr. Peterson has been with Dow since 1936 and played a large part in the company's development of Ethocel (ethylcellulose) and Ethocel Sheeting.

**The American Zinc Sales Co.**, Columbus, O., has appointed George R. Throop, Jr., Chicago district manager, with offices in the Chicago Temple Bldg., 77 W. Washington Ave., Chicago, Ill. Mr. Throop has been with American Zinc since 1940, and prior to this new appointment was in the company's offices in St. Louis, Mo.

**Inland Rubber Corp.**, 146 W. 27th St., Chicago 16, Ill., has appointed Charles A. Rountree sales manager of its export division, according to Howard C. Kenyon, general sales manager. Mr. Kenyon pointed out that Inland tires and other rubber and automotive products sold nationally in the United States would now be sold in foreign countries under the direction of Mr. Rountree, whose headquarters are at 63 Wall St., New York, N. Y. Mr. Rountree, formerly assistant manager of Seiberling Rubber Export Co., entered the tire industry in 1935 and his background includes also several posts with Goodyear Tire & Rubber Co. During the war he served three years in Europe.



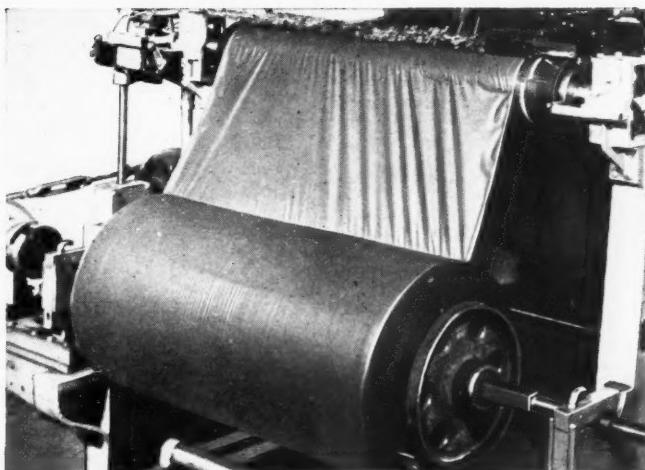
**Aerial View of New G-E Silicone Plant at Waterford, N. Y.**

# TACKY?

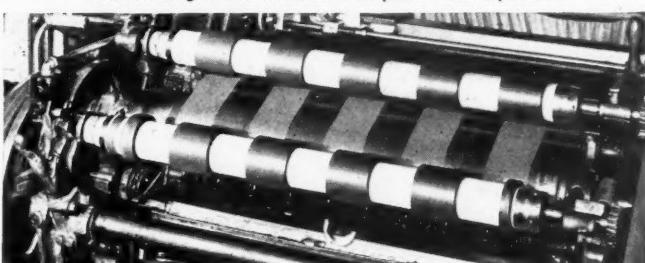
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of narrow width on

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## Monsanto Elects Smith

The election of Arnold H. Smith as president of Monsanto (Canada), Ltd., with offices in Montreal, P. Q., was announced July 9 by William M. Rand, president of Monsanto Chemical Co., St. Louis, Mo. At the same time, Mr. Rand stated that Leo G. Ryan would remain as chairman of the board. Mr. Ryan, largely responsible for the growth of the Canadian company, had been president since 1933.

Concurrently, L. E. Ryan was elected first vice president of the company. A graduate of McGill University, L. E. Ryan has been associated with Monsanto (Canada) since its organization. When the company was reorganized in 1946, he was elected vice president and in 1947 was elected a director. He will remain in charge of the manufacturing and development programs of the Canadian firm.

Mr. Smith, a native of Akron, O., was elected a vice president and a director of the Canadian company on January 1, 1948. Prior to that time he had been acting managing director of Monsanto (Australia) Pty., Ltd., and before this assignment, which began in December, 1946, Mr. Smith had been director of Monsanto's foreign department. He first joined the company in 1922, after serving a few years with rubber companies, and held many executive positions at Monsanto.

Monsanto, through Vice President Francis J. Curtis, has also announced the inauguration of a program which will permit university and college faculty members in chemical engineering to gain a full year of on-the-job experience in the chemical industry. Teachers chosen for participation in the program will be paid the salary ordinarily paid for comparable jobs within the company, and their moving expenses to and from the plant to which they are assigned will also be paid by Monsanto. The plan is designed to give younger teachers much-needed practical experience in industrial operations. Mr. Curtis said, and enable them to give more effective guidance to students under them who are about to enter the industry. First teacher chosen in the program is Robert V. Andrews, assistant professor in the department of chemical engineering of Texas Agricultural & Mechanical College. He will join Monsanto on September 1 for one year's service in the company's Anniston, Ala., plant, Mr. Curtis revealed. Teachers will be expected to resume their faculty affiliations for one year at the conclusion of their Monsanto service. It is the hope of Monsanto that other companies in the chemical industry will institute similar programs. Mr. Curtis further declared, in a collective effort to blend practical industrial experience on the part of faculty members with normal academic qualifications.

Paul O. Huntington has been elected vice president of New England Alcohol Co., a subsidiary of Monsanto, which maintains an alcohol and dry ice plant at the Everett, Mass., headquarters of Monsanto's Merrimac Division. The new vice president joined the company in 1935. He will continue to serve as sales manager for New England Alcohol.

## Beall Named Vice President

Phillips Petroleum Co., Bartlesville, Okla., has elected K. E. Beall vice president, economics department, to succeed



K. E. Beall

J. M. Sands, who reached retirement age. Mr. Beal joined Phillips in 1920 as a production engineer. Upon the organization of the economics department he transferred to that department and since 1946 has served as manager.

### Forms Chemicals Subsidiary

Chemical activities of Phillips Petroleum have been expanded through the formation of a wholly owned subsidiary, Phillips Chemical Co., it was announced last month. The new company was organized to conduct Phillips Petroleum's chemical and synthetic rubber operations as well as its furnace-type carbon black operations now handled by another wholly owned subsidiary, Philtex Chemical Co. Key officers of Phillips Chemical Co. are Frank Phillips, chairman; K. S. Adams, president; Ross W. Thomas, executive vice president; Paul Endacott, Don Emery, G. G. Oberfell and R. C. Jopling, vice presidents. G. W. McCullough has been appointed vice president and general manager.

As a nucleus of the new program, Phillips Chemical has leased on a long-term basis the Cactus Ordnance Works at Etter in the Texas Panhandle and will also build a new ammonium nitrate plant at Etter. Cactus Ordnance, one of the largest ammonia plants in the world, will be used to produce ammonia for nitrogenous fertilizers. Present plant capacity will be doubled to more than 140,000 tons. Under the lease agreement the United States Government may purchase products from this plant for its foreign relief export fertilizer program until June 30, 1952.

The company's plans for the future also include the acquisition of a large site on the ship channel near Houston, Tex., where a plant will be built for the manufacture of ammonium sulfate, another important type of fertilizer. This site is of sufficient size to permit the addition of the several other chemical plants which are planned.

**Underwriters' Laboratories, Inc.**, Chicago, Ill., recently elected the following officers: chairman, J. C. Harding; vice chairman, Alvah Small; president, C. R. Welborn; vice president and chief engineer, John A. Neale; vice president and electrical engineer, Merwin M. Brandon; secretary, W. S. Austin; and treasurer, H. F. Duncan.

## PACIFIC COAST

**Permalite Plastics Co.**, 8617 3/4 W. Third St., Los Angeles 36, Calif., has been appointed to handle sales, distribution, and promotion of a complete line of peroxides manufactured by Union Bay State Chemical Co., Inc., Cambridge, Mass. Establishment of the Permalite company as a UBS agency enables the Cambridge firm to supply West Coast customers with a more complete and efficient service. Inquiries pertaining to the company's products, shipments, or consultation service should be referred to Kenneth W. Woodson, Permalite president.

**Universal Rubber Corp.**, 960 Harrison St., San Francisco 7, Calif., has announced that its mechanical rubber goods division has been taken over by the General Insulation & Supply Co. The consolidation of these two operations will be carried on by a new California corporation, General Insulation & Rubber Corp., also at 960 Harrison St. The executive personnel of this new corporation includes Claude M. Hammond, Harry J. Williams, and William W. Hastie, who operated General Insulation & Supply Co., and Read Givens, for the past two years in charge of the mechanical rubber goods division of Universal Rubber. The same employees heretofore employed by the preceding organizations are being retained by the new corporation, which will devote itself primarily to industrial rubber goods, insulation contracting in all of its phases, and insulation materials of all kinds.

**The San Francisco Chapter** of the California State Tire Dealers Association last month held its second meeting at the PG&E Auditorium. J. C. Whitelaw, served as honorary chairman. Principal speaker was Sam Barnblatt, president of the California Tire Co., who outlined functions of the National Association of Independent Tire Dealers, to which all members of local and state chapters automatically belong upon joining the San Francisco chapter. Mr. Barnblatt also outlined the beneficial reasons for the formulation of state and local chapters within the national tire dealer set-up. As guest speaker of the evening, Jack Soward, public relations director of the National Safety Council, spoke on what tire dealers individually and collectively can do to promote safety campaigns.

## Canada

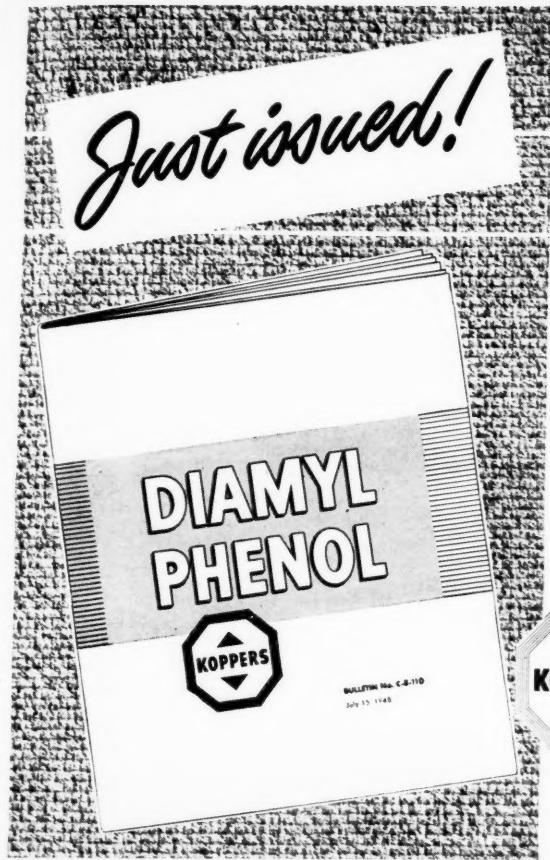
**British Rubber Co. of Canada, Ltd.**, Montreal, P. Q., has been authorized to increase its common share capitalization and change its name under recently issued supplementary letters patent. The company may raise its common share capitalization to 250,000 no par value shares. Current number of shares is 50,000. Provision is also made that the amount of capital with which the company will carry on business is fixed at not less than \$2,200,000. Also authorized under the Quebec Companies' Act is approval of special by-law N changing the corporation name to Mailman Corp., Ltd.

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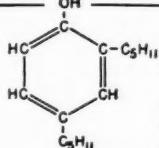
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### Koppers Bulletin C-8-110



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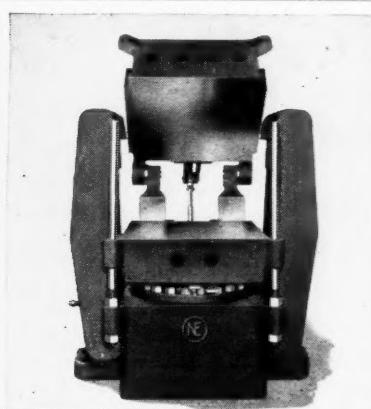
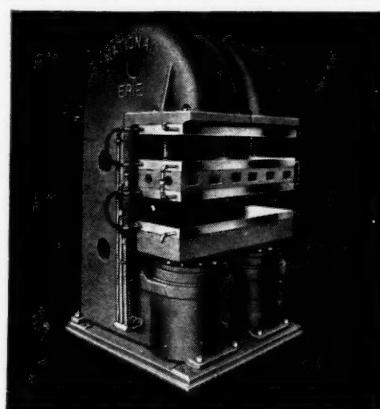
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# Patents and Trade Marks

## APPLICATION

### United States

2,442,495. Stocking Creasing Pad of Yielding, Resilient Thermoplastic Resin Having a Roughened Surface Which Is a Replica of the Surface of a Closely Woven Textile Fabric. R. W. Fornwalt, Lebanon, Pa.

2,442,493. Skin Graft-Receiving Member, Including a Flexible Strip of Rubber With One Surface Smooth and the Other Adhesive. J. D. Reese, Philadelphia, Pa.

2,442,497. Stocking and Leg Protector of Waterproof Material. R. T. J. Murphy, Crestline, O.

2,442,656. Cavitied Nusser Nipple. J. W. Less, Clinton, Iowa.

2,443,687. Packing Ring Including a Web of Resilient Material V-Shaped in Cross-Section to Permit Stacking of Several Such Rings When Used. E. B. Heathcott, assignor to Universal Packing & Gasket Co., both of Houston, Tex.

2,442,749. Wrap-Around Raincoat. J. T. Callahan, West Newton, and J. A. Gilbertson, assignors to Archer Rubber Co., both of Milford, both in Mass.

2,442,855. Garment Supporting Belt Including an Elastic Strip Wholly Enclosed between Separable Portions of the Belt. M. Luftig, Chicago, Ill.

2,442,919. Plastic Tube Bearing. A. Conhaugen, assignor to Alfred Conhaugen, Inc., both of New York, N. Y.

2,442,996. Emergency Tire. R. T. Conley, Millington, Md.

2,443,201. Rubber Cushioning Device. N. Sluyte-Haartem, Netherlands; vested in the Attorney General of the United States.

2,443,225. In a Brassiere, Stiff Supporting Members Including Metal Reinforced Rubber Strips. E. Cadous, New York, N. Y.

2,443,328. Traction Wheel Including a Resilient Tire Having a Chamber for an Inflating Medium; This Medium Has Liquid and Vapor Phases at Atmospheric Temperature. E. F. Saver, assignor of one-half to G. W. Werman, both of Wichita, Kan.

2,443,446. Collapsible Swimming and Bathing Pool, Including a Water-Impervious Bottom Wall and a Collapsible Inflatable Side Wall. O. J. Alvarez, assignor to Alvarez Patent Corp., both of New York, N. Y.

2,443,569. Nursing Nipple. G. W. Goodson, North Haven, assignor to Seamless Rubber Co., New Haven, both in Conn.

Protective Waterproof Garment for Animals. L. A. Miller, Riverside, Ill.

2,443,941. Exclusive Vaginal Diaphragm of Flexible, Impermeable Material. T. Young, assignor to Purex Products Inc., both of New York, N. Y.

2,444,007. Power Transmission Belt. E. A. Davis, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

### Dominion of Canada

448,715. Composite Heat-Molded Article with Walls Made of Two Sheets of Fabric with Thermosetting Plastic between Them and Elastomeric on Both Exposed Faces. W. R. Hickok, Winthrop, Mass., assignor to B. F. Goodrich Co., New York, N. Y., both in the U.S.A.

448,750. High Wet-Strength Paper Made with a Water-Soluble Thermosetting Resin. R. W. Auten, Jenkintown, and G. V. N. Moran, Wayne, assignors to Resinous Products & Chemical Co., Philadelphia, all in U.S.A.

448,771. Resilient Lubricant Seal. L. R. Buckland, assignor to Timken-Detroit Axle Co., both of Detroit, Mich., U.S.A.

448,776. Wiper Blade for Curved Windshields. A. C. Scinta, assignor to Trico Products Corp., both of Buffalo, N. Y., U.S.A.

448,811. Friction Surface Belt Consisting of a Strip of Knitted Textile Fabric Stretched to Straighten the Yarns, and Impregnated with Rubber; the Rubber Constitutes a Friction Surface for Both Faces of the Belt. G. A. Sowerby and W. S. Short, assignors to George Angus & Co., Ltd., all of Newcastle-on-Tyne, Northumberland, England.

448,864. Elastic Fabric Including Elastic Rubber Thread, and at Least One Continuous Film of a Thermoplastic Elastomer Bonded to Superficial Portions of at Least One Surface of the Fabric. C. S. Francis, Jr., West Harwich, Mass., assignor to Sylvania Industrial Corp., Fredericksburg, Va., assignor to Amer-

ican Viscose Corp., Wilmington, Del., all in the U.S.A.

448,906. Windshield Cleaner. A. C. Scinta, assignor to Trico Products Corp., both of Buffalo, N. Y., U.S.A.

449,005. In a Sealing Apparatus for Effecting a Seal Between Relatively Rotatable Elements, a Rubber-Like Bellows Member Surrounding a Shaft. F. E. Payne, Glenoak, assignor to Crane Packing Co., Chicago, both in Ill., U.S.A.

449,051. Windshield Cleaner. E. C. Horton, Hamburg, assignor to Trico Products Corp., Buffalo, both in N. Y., U.S.A.

449,124. Treating a Formed Article of a Crystalline Vinylidene Chloride Polymer. E. H. Harder, Denver, Colo., assignor to Dow Chemical Co., Midland, Mich., both in the U.S.A.

449,125. Wire-Reinforced V-Belts. A. L. Freedlander, E. H. Kremer, and D. L. Waugh, assignors to Dayton Rubber Co., (formerly Dayton Rubber Mfg. Co.), all of Dayton, O., U.S.A.

## CHEMICAL

### United States

2,442,330. Producing an Infusible, Insoluble Polymer by Heating a Mixture of a Linear Polyvinyl Ester and at Least 5% of an Organic Peroxide. C. S. Fuller, Chatham, N. J., assignor to Bell Telephone Laboratories, Inc., New York, N. Y.

2,442,341. Alkaline Aqueous Rubber Dispersions Stabilized with the Aid of a Zinc Oxide and a Condensation Product of Ethylene Oxide and a Glycol Having at Least Four Ethoxy Groups. M. R. Buffington, Millburn, N. J.

2,442,542. Production of Chloroacetonitrile by Treating an Aqueous Solution of Ammonium Acetonitrile with Hydrochloric Acid and Adding Sodium Nitrite. I. Hechenbleikner, Stamford, Conn., assignor to American Cyanamid Co., New York, N. Y.

2,442,558. Plasticized Copolymers of Compounds Containing a Single CH=CH Group and Diesters of Ethylene-Alpha, Beta-Dicarboxylic Acids. G. F. D'Alelio, assignor to Pro-phy-lac-tic Brush Co., both of Northampton, Mass.

2,442,588. Rubbery Product Obtained by Polymerizing with a Peroxide Catalyst a Mixture of Liquid, Partially Polymerized Benzyl Acrylate, Ethyl Acrylate, Acrylonitrile, and Butadiene. G. F. D'Alelio, Pittsfield, Mass., assignor to General Electric Co., a corporation of N. Y.

2,442,613. Polysloxane Electrical Insulating Composition. P. O. Nicodemus, York, Pa., assignor to General Electric Co., a corporation of N. Y.

2,442,643-645. Polymerization of Hydrocarbons in the Presence of Boron Fluoride Catalyst and Sulfur Dioxide. W. E. Elwell and R. L. Meier, Berkeley, assignors to California Research Corp., San Francisco, both in Calif.

2,442,716. Methyl Acrylate from Methyl Lactate. S. M. Weisberg and E. G. Stimpson, both of Baltimore, Md., assignors, by mesne assignments, to National Dairy Research Laboratories, Inc., New York, N. Y.

2,442,747. Preparing Hard Tough Resins by Condensation in the Presence of an Acidic Catalyst of a Carbamide, and Aldehyde and Allyl Alcohol or Methallyl Alcohol. R. W. Auten, Jenkintown, Pa., and W. L. Evers, Moorestown, N. J., assignors to Resinous Products & Chemical Co., a corporation of Delaware.

2,442,781. In Compounding Synthetic Rubber, the Incorporation of the Reaction Product of Mineral-Oil Extract and Sulfur. F. S. Rostler, assignor to Wilmington Chemical Corp., both of Wilmington, Del.

2,442,810. Making a Condenser Dielectric by Coating a Film of Polystyrene with Low-Molecular Weight Polystyrene Dissolved in Carbon Tetrachloride and Butyl Alcohol and Mixed with Commuted Titanium Dioxide. W. O. Haas, Jr., Wilmette, Ill., assignor to Western Electric Co., Inc., New York, N. Y.

2,442,897. Resinification of Ligno-Cellulose Materials with Urea-Formaldehyde. W. K. Loughborough, Madison, Wis., assignor to United States of America, as represented by the Secretary of Agriculture.

2,442,957. Condensation Product of Ethylene Sulfide and Guanidine. L. P. Moore, New York, N. Y., and W. P. Erickson, Stamford, Conn., assignors to American Cyanamid Co., New York.

2,442,958. Polymeric Reaction Product from Equivalent Amounts of Trimethyladipic Acid and an Amine. R. C. Morris and H. Danenber, Berkley, and H. de V. Finch, El Cerrito, assignors to Shell Development Co., San Francisco, all in Calif.

2,442,993. Dehydrofluorination of Polyfluoroalkanes. O. W. Cass, Niagara Falls, N. Y., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,443,003. Organic Fluorine-Containing Sulfur Compounds. W. E. Hanford, Easton, Pa., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,443,005. Vinyl Ester of a Polyfluorocyclo-

## PROCESS

### United States

2,442,338. Making Plastic Articles by Injection Molding. C. E. Maynard, assignor to Pro-phy-lac-tic Brush Co., both of Northampton, Mass.

2,442,398. Finishing Plastic Sheet Material. A. Y. Harrison, Arlington Heights, and E. G. Pinkerton, Bedham, assignors to Boston Woven Hose & Rubber Co., Cambridge, all in Mass.

2,442,757. Progressively Stretching a Web of Plastic Material. W. S. Cloud, Wilmette, Ill.

2,442,876. Pressure-Sensitive Adhesive Sheet-  
ing. J. W. Pearson, assignor to Minnesota Mining & Mfg. Co., both of St. Paul, Minn.

2,442,919. Shaped Porous Masses of Thermoplastic Synthetic Resinous Material. H. P. Staudinger, Ewell, B. K. Kelly, Wimbledon, London, and A. Cooper, Sandstead, all in England, assignors of one-half to Distillers Co., Ltd., Edinburgh, Scotland, and one-half to Expanded Rubber Co., Ltd., Croydon, England.

### United Kingdom

448,715. Pressure-Sensitive Adhesive Sheet-  
ing or Tapes. A. H. Stevens (Minnesota Mining & Mfg. Co.).

448,413. Threads and Similar Articles from Polyvinyl Compounds. Soc. Rhodaceta.

448,826. Moisture-Proof Sheet or Film. British Celophane, Ltd.

448,173. Laminated Waterproof Fabrics. Sylvania Industrial Corp.

### Dominion of Canada

448,829. Forming Granulated Synthetic Resin Compositions. L. Smith, New York, N. Y., U.S.A.

448,843. Rubberized Belting. G. A. Sowerby and W. S. Short, assignors to George Angus & Co., Ltd., all of Newcastle-on-Tyne, Northumberland, England.

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**butane-Monocarboxylic Acid.** R. A. Jacobson, Landenburg, Pa., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

**2,445,044. Copolymerization of Unsaturated Glycidyl Oil and a Hydrocarbon of a Class Consisting of Cyclopentadiene and Lower Polymers Thereof up to the Pentamer.** W. H. Lycan and H. L. Gerhart, Milwaukee, Wis., assignors to Pittsburgh Plate Glass Co., a corporation of Pa.

**2,443,167. Copolymers of a Mixture of Vinyl Acetate and an Allylidene Dihalide.** L. M. Minsk and W. O. Kenyon, assignors to Eastman Kodak Co., all of Rochester, N. Y.

**2,443,197. Use of a Liquid Alkaline Hardening Accelerator to Accelerate the Setting Properties of a Dihydroxy Benzene-Aldehyde Adhesive.** P. H. Rhodes, Portland, Me., assignor, by mesne assignments, to Koppers Co., a corporation of Del.

**2,443,217. Making a Polymerizable Alkenyl-Aromatic Compound Having a Molecular Weight Greater Than That of Styrene.** J. L. Amos, Midland, and F. J. Soderquist, Bay City, assignors to Dow Chemical Co., Midland, both in Mich.

**2,443,245. Isobutylene Purification.** H. J. Hubshman, Plainfield, N. J., assignor to Standard Oil Development Co., a corporation of Del.

**2,443,353. Organosiloxanes.** J. F. Hyde and W. H. Dandt, assignors to Corning Glass Works, all of Corning, N. Y.

**2,443,368. Composition Including a Major Proportion of a Urea-Formaldehyde Resin and a Minor Proportion of an Alkali Lactate.** J. R. Alexander, D. Burton, and F. Hausmann, assignors to William Walker & Sons Ltd., all of Bolton, England.

**2,443,385. Preparation of Chloroalkylamine Hydrochloride by Reacting a Hydroxyalkylamine Hydrochloride with Chlorine in the Presence of Sulfur, Sulfur Monochloride, or Sulfur Dichloride.** A. F. Hardman, assignor to Wingfoot Corp., both of Akron, O.

**2,443,409. Compound Containing a Cellulose Derivative and a Plasticizer Formed from an Acyclic Aliphatic Conjugated Diolefin and Formaldehyde.** T. C. Whitmer, Elizabeth, N. J., assignor to Standard Oil Development Co., a corporation of Del.

**2,443,450. Flexible Article Coated with a Film of N-Alkyoxymethyl Polyamide.** B. Graham, Wilmington, Del., and H. S. Turner, Swarthmore, Pa., assignors to E. I. du Pont de Nemours & Co., Inc., Wilmington.

**2,443,451. Epsilon-Caprolactone.** W. E. Grigsby, assignor to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, Del.

**2,443,486. N-Methylol Polyamides.** W. W. Watkins, Buffalo, N. Y., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington.

**2,443,494. Reacting Succino-Nitrile with Chlorine in the Liquid Phase in the Presence of Light to Produce Unsaturated Chloronitriles.** O. W. Cass, Niagara Falls, N. Y., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

**2,443,496. Copolymer of Dihydropyran and a Vinyl Ester of a Carboxylic Acid Having no Ethylenic or Acetylenic Unsaturation.** N. W. Fiedlin, Niagara Falls, N. Y., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

**2,443,566. Flame-Resistant Coating, Including a Water Dispersion of Polyvinyl Acetate Binder, a Flame-Resistant Plasticizer of Tricresyl Phosphate, and a Flame-Resistant Metallic Filler of Antimony Trioxide.** R. Loveland, Dunellen, assignor to Johnson & Johnson, New Brunswick, both in N. J.

**2,443,576. Mixing Lignin with Abietic Acid and Heating to at Least 300° C. to Produce Lignin Resins.** E. Farber, assignor to Timber Engineering Co., both of New Haven, Conn.

**2,443,613. Polyethylene Isopropylene Sebacate Adhesive Compositions.** C. S. Fuller, Chatham, N. J., assignor to Bell Telephone Laboratories Inc., New York, N. Y.

**2,443,678. Cement Including a Solvent, Chlorinated Rubber, and a Copolymer of Butadiene-1, 3 and Acrylonitrile.** B. S. Garvey, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

**2,443,688. Abrasive Composition for Use in Grinding and Lapping Operations, Including Abrasive Grains Dispersed in a Carrier Base Consisting of a Tackify Butylene Polymer, a Lubricating Oil, a Fatty Acid, and a Liquid Phenol-Formaldehyde Resin.** J. Y. Snyder, assignor to Wedgeplug Valve Co., both of New Orleans, La.

**2,443,735. Emulsion Copolymerization of Unsaturated Alkyd Resins.** E. L. Krupa, Old Greenwich, Conn., assignor to American Cyanamid Co., New York, N. Y.

**2,443,736. Copolymer of an Unsaturated Alkyd Resin and Diallyl Phthalate.** E. L. Krupa, Old Greenwich, Conn., assignor to American Cyanamid Co., New York, N. Y.

**2,443,737. Copolymer of an Unsaturated Alkyd Resin and a Poly(allyl Ester of a Saturated Aliphatic Polycarboxylic Acid).** E. L. Krupa, Old Greenwich, Conn., assignor to American Cyanamid Co., New York, N. Y.

**2,443,738. Copolymer of Diallyl Maleate and an Esterification Product of a Polyhydroxy Alcohol, an Alpha Unsaturated Alpha, Beta-Polycarboxylic Acid and a Polycarboxylic Acid.** E. L. Krupa, Old Greenwich, Conn., assignor to American Cyanamid Co., New York, N. Y.

**2,443,739 and 2,443,741. Copolymer of Unsaturated Alkyd Resin and Polyallyl Ester.** E. L. Krupa, Old Greenwich, Conn., assignor to American Cyanamid Co., New York, N. Y.

**2,443,817. Copolymerization of Isobutylene and Isoprene to Produce a Rubbery Copolymer.** A. A. Draeger, Baytown, and H. G. Schutze, Goose Creek, both in Tex., assignors to Standard Oil Development Co., a corporation of Del.

**2,443,835. Stabilization of Mercaptans.** C. J. Pedersen, Penngrove, N. J., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

**2,443,852. Condensation of Olefine Compounds with Hydrogen Sulfide.** J. L. Eaton, Trenton, N. J., and J. F. Olin, Grosse Ile, Mich., assignors to Sharples Chemicals, Inc., Philadelphia, Pa.

**2,443,889. Adhesive from Lignin Sulfonic Acid and Polyvinyl Alcohol.** D. S. Bruce and H. L. Heise, assignors to Gummed Products Co., all of Troy, O.

**2,443,893. Stable Aqueous Emulsion of High Polymeric Condensation Resins.** H. M. Collopy, Stamford, Conn., assignors to Shawinigan Chemicals, Ltd., Montreal, P. Q., Canada.

**2,443,898. Polymeric Beta-Hydroxyethyl Silicic Acids.** E. K. Ellingboe, assignor to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, Del.

**2,443,902. Obtaining Increased Yields of Dithioketidhalogenosulphones.** C. S. Ferguson, Troy, and J. E. Sellers, Scotia, both in N. Y., assignors to General Electric Co., a corporation of N. Y.

**2,443,915. Copolymer of Styrene with an Ester of an Unsaturated Dicarboxylic Acid and an Hydroxy Acid Esterified with an Unsaturated Alcohol.** J. L. Jones, assignor by mesne assignments to Libbey-Owens-Ford Glass Co., both of Toledo, O.

**2,443,918. Light-Diffusing Cellulose Acetate Compositions.** J. E. G. Lahousse, Lyon, and A. Renouprez, Le Peage-de-Roussillon, assignors to Societe des Usines Chimiques Rhone-Poulenc, Paris, all in France.

**2,443,923. Interpolymer. A Mercapto Carboxylic Acid Ester of a Hydrolyzed Ethylene-Vinyl Acetate.** C. W. Mortenson, assignor to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, Del.

**2,443,998. Improved Cement, Including a Blend of Polyvinyl Butyral Resin and Polyvinyl Acetate Resin Dissolved in Monoethyl Ester of Ethylene Glycol.** C. M. White, assignor to Genesee Research Corp., both of Rochester, N. Y.

## Dominion of Canada

**448,679. Production of Toluene-Soluble Polyvinyl Chloride by Dispersing Vinyl Chloride in an Aqueous Medium Containing Formaldehyde and a Polymerization Catalyst.** P. W. Denny, Runcorn, Cheshire, England, assignor to Canadian Industries, Ltd., Montreal, P.Q.

**448,682. For Use in the Manufacture of Plywood, an Adhesive Composition Including a Polyvinyl Resin, the Reaction Product of a Linear Polymeric Polycarboxylic Acid and a 37-57% Hydrolyzed Polyvinyl Acetate, and a Solvent.** L. L. Blyler, Spotswood, J. W. Clough, Parlin, both in N. J., C. W. Hawley, Stamford, Conn., and E. C. Pitman, Red Bank, N. J., both in the U.S.A., assignors to Canadian Industries, Ltd., Montreal, P.Q.

**448,685. Vinyl Cyanide.** C. R. Harris, Lockport, N. Y., U.S.A., assignor to Canadian Industries, Ltd., Montreal, P.Q.

**448,687. Thiourea Derivatives of Polymeric Compounds.** E. F. Izard, Kenmore, N. Y., and B. W. Hawk, Wilmington, Del., both in the U.S.A., assignors to Canadian Industries, Ltd., Montreal, P.Q.

**448,690. Composition Consisting of a Normally Solid Homopolymer of Ethylene and Diphenylamine-Acetone Condensation Product.** D. E. Strain, Wilmington, Del., U.S.A., assignor to Canadian Industries, Ltd., Montreal, P.Q.

**448,693. Vinyl Cyanide.** H. D. Green, Pasadena, and D. Stison Taylor, Monrovia, both in Calif., U.S.A., assignors to Canadian Industries, Ltd., Montreal, P.Q.

**448,696. Polyvinyl Alcohol Article Containing, as Plasticizer therefor, an Amine Aduct of Butadiene Cyclic Sulfone.** C. W. Mortenson, Newark, Del., U.S.A., assignor to Canadian Industries, Ltd., Montreal, P.Q.

**448,698. Coating Composition Containing a Substantial Amount of a Conjoint Polymer of a Vinyl Halide, a Vinyl Ester of a Lower Saturated Fatty Acid, and an Aliphatic Alpha, Beta-Mono-Olefinic Carboxylic Acid.** W. E. Campbell, Jr., Taft, Calif., U.S.A., assignor to Carbide & Carbon Chemicals, Ltd., Toronto, Ont.

**448,716. In the Manufacture of Compound Fibres, Treating a Fabric with a Solution in a Volatile Organic Solvent of Formaldehyde, Urea, Polyvinyl Acetal, a Plasticizer and a Catalyst Promoting the Condensation of Urea and Formaldehyde.** H. Meyer, Richmond, assignor to Hart Productions, Ltd., London, both in England.

**448,721. A Textile Decorating Emulsion Including a Disperse Phase of Pigmented Resin-Solvent Aggregate Derived from a Pigmented Heat-Converted Resin.** N. S. Cassel, Ridgewood, N. J., assignor to International Corp., New York, N. Y., both in the U.S.A.

**448,727. Insulating Material Including about 50% of Polymerized Styrene having a Molecular Weight of 80,000-120,000, 30% Polymerized Styrene of Molecular Weight 6000-20,000, and 20% Plasticizer, by Weight.** A. J. Warner, South Orange, and M. Bakst, Newark, both in N. J., assignors to International Standard Electric Corp., New York, N. Y., both in the U.S.A.

**448,867. Improving the Adhesion of Rayon Yarn and Rubber Compositions by Incorporating Casein in the Viscose from Which the Rayon Yarn Is Formed.** J. W. Illingworth, Birmingham, Warwick, England, assignor to Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.

**448,874. Catalyst for Use in the Polymerization of Butadiene-1,3 and at Least One Unsaturated Organic Compound Which Contains a  $\text{CH}_2=\text{C}\text{H}$  Group.** W. B. Stewart, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y., both in the U.S.A.

**448,881. Making Low Molecular Weight Lignin Degradation Products.** J. R. Salvesen, R. L. Hossfeld and R. J. Lovin, Wausau, assignors to Marathon Corp., Rotheschild, both in Wis., U.S.A.

**448,887-888. High Molecular Weight Heteropolymers of Sulfur Dioxide and Olefins.** F. E. Frey and First National Bank of Bartlesville, administrators of the estate of Louis H. Fitch, Jr., deceased, in his lifetime of Bartlesville, co-inventor with F. E. Frey, assignors to Phillips Petroleum Co., all of Bartlesville, Okla., U.S.A.

**448,891. Acrylonitrile.** Le R. U. Spence, Elkins Park, D. J. Butterbaugh, Abington, and E. H. Kroeker, Cheltenham, assignors to Rohm & Haas Co., Philadelphia, all in Pa., U.S.A.

**448,963. Production of Butadiene by Passing Ethanol over a Catalyst Including Magnesium Oxide and Silica at an Elevated Temperature.** W. Szukiewicz, Philadelphia, Pa., U.S.A.

**449,026. Improved Adhesives Including a Thermosetting Liquid Synthetic Resin in Which Is Incorporated Finely Divided Wood Flour.** W. C. Dearing and K. D. Meiser, assignors to Plaskon Co., Inc., assignor to Libbey-Owens-Ford Glass Co., Toledo, O., U.S.A.

**449,144. Compounding Butadiene-Styrene Copolymer with a Vulcanizing Agent, Para-Comarone Resin and a Metal Oxide Filler.** T. A. Bulifant, Hackensack, N. J., assignor to Allied Chemical & Dye Corp., New York, N. Y., U.S.A.

**449,119. Resinous Reaction Product of Melamine, Formaldehyde, and an Acetylhydrazine Diamino Pyrimidine.** G. F. D'Allelio and J. W. Underwood, Pittsfield, Mass., U.S.A., assignor to Canadian General Electric Co., Ltd., Toronto, Ont.

**449,121. Organic Plastic Material Obtained by Reacting an Aldehyde or Ketone with a Hydrolyzed Thermoplastic Polymer of a Vinyl Ester of a Monocarboxylic Acid and a Guanazole.** G. F. D'Allelio, Pittsfield, Mass., U.S.A., assignor to Canadian General Electric Co., Ltd., Toronto, Ont.

**449,158. Molding Composition Including the Finely Subdivided Ion Exchange Compound of a Base Exchange Finely Divided Solid and an Ionizable Salt of a Polymerizable Olefinic Carboxylic Acid.** E. A. Hauser and E. M. Dannenberg, Cambridge, Mass., assignors to Research Corp., New York, N. Y., both in the U.S.A.

## United Kingdom

**600,145. Treating Copolymers.** Imperial Chemical Industries, Ltd.

**600,146. Condensation Products of Thiourea.** E. I. du Pont de Nemours & Co., Inc.

**600,249. Solutions of Polymeric Materials.** E. I. du Pont de Nemours & Co., Inc.

**600,296. Fluorohydrocarbons.** Imperial Chemical Industries, Ltd.

**601,308. Mixed Aldehyde Condensation Products.** American Cyanamid Co.

**601,317. Rubber-Like Polymers.** J. C. Arnold, Standard Oil Development Co.

**601,390. Emulsion Polymerization.** C. Arnold, Standard Oil Development Co.

**601,452. Vinyl Resin Suspensions.** Carbide & Carbon Chemical Corp.

**601,479. Plasticized Rubber-Like Polymers.** Standard Oil Development Co. and J. C. Arnold.

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## MACHINERY

### United States

2,442,333. **Card Feed Rolls in a Carding Machine.** H. M. Bacon, Dayton, O., assignor to Dayton Rubber Co., a corporation of O. 2,442,443. **Apparatus for Planishing Thermoplastic Material.** H. A. Swallow, Plainfield, N. J., assignor to Bakelite Corp., a corporation of N. J.

2,442,459. **Repair Vulcanizer.** H. T. Kraft, assignor to General Tire & Rubber Co., both of Akron, O.

2,442,607. **Apparatus for Molding Articles of Rubber-Like and Other Thermosetting Plastic Materials.** C. W. Leguillon, Akron, G. L. Matthias, Silver Lake, and E. Herzog, Cuyahoga Falls, all in O., assignors to B. F. Goodrich Co., New York, N. Y.

2,442,653. **Apparatus for Manufacturing Thin-Walled Collapsible Tubes of a Thermoplastic Resin.** W. H. Parmelee, Bethel Township, assignor to Wheeling Stamping Co., Wheeling, both in Pa.

2,442,288. **Organic Plastic Material Extruder.** J. Bailey, West Hartford, assignor to Plax Corp., Hartford, both in Conn.

2,442,386. **Apparatus for Molding Strip Material.** U. C. Haren, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,442,551. **Tire Building Apparatus.** R. J. Beam, Detroit, Mich.

2,442,554. **Molding Apparatus for Plastics.** P. Mattia, Clifton, N. J.

2,442,594. **Apparatus for Dielectrically Heating Molding Materials.** J. R. Boettler, Chatham, N. J., and R. Burns, Garden City, assignors to Bell Telephone Laboratories, Inc., New York, both in N. Y.

2,442,956. **Device for Use in Retreading and Vulcanizing Pneumatic Tires.** A. G. Guzik, Vicente Lopez, Argentina.

## OBITUARY

### C. J. Harwick

AFTER a three-week illness Curtis J. Harwick, president of Harwick Standard Chemical Co., Akron, O., died at his home there on July 26. Services were held at Willow Chapel, Akron, on July 29, followed by burial in Rose Hill Cemetery.

Mr. Harwick was widely known for his work as a rubber chemist. He was with the B. F. Goodrich Co. from 1922 until 1932, when he organized his own company, which manufactures and distributes compounding ingredients for rubber and plastics and is now erecting a new plant for synthetic resin production and chemical research.

The deceased was born in Athens, O., 48 years ago. He attended the Ohio University prep school there and in 1922 came to the Rubber City to matriculate at the University of Akron, from which he was graduated in 1926 with a degree in chemistry.

Mr. Harwick belonged to the American Chemical Society and was active in the Akron Rubber Group. He was also a director of the Akron Savings & Loan Co. and a member of Phi Delta Theta, the Chamber of Commerce, and the University, Akron City, and Portage Country clubs.

Survivors include the widow, a son, a daughter, and two sisters.

## UNCLASSIFIED

### United States

2,442,337. **Joint for Coaxial Cables.** H. Burkby, assignor to Standard Telephones & Cables, Ltd., both of London, England.

2,442,366. **Joint for Electric Power Cables.** J. A. Leno and N. Woodhouse, London, England, assignors to International Standard Electric Corp., New York, N. Y.

2,442,649. **Method of Installing an Annular, One-Piece Rubber Boot on a Universal Joint.** G. E. Dunn, Dearborn, assignor to Universal Products Co., Inc., Detroit, both in Mich.

2,442,714. **Axially Shifting-Type Adjustable Tire Stripper.** C. Stack, Gary, Ind.

2,442,956. **Tire Deflation Indicating Device.** P. H. Meroney, Canby, Calif.

2,442,219. **Tire Skid Chain.** G. T. Backe, Jr., Jersey City, N. J.

2,442,406. **Traction Device.** C. R. Thompson, Salt Lake City, Utah.

## TRADE MARKS

### United States

438,982. **Velsicol.** Resins. Velsicol Corp., Chicago, Ill.

438,993. Representation of a faniful design containing the word "Velsicol." Resins. Velsicol Corp., Chicago, Ill.

438,998. **Sell-Patt.** Footwear. W. P. Sellers and J. K. Patterson, Shelby, N. C.

439,001. Representation of a bird and the words "Rhythm Step Ramblers, The 1 2 3 Shoe." Footwear. Johnson, Stephens & Shinkle Shoe Co., St. Louis, Mo.

439,025. Representation of a girl. Footwear. Henri Bendel, Inc., New York, N. Y.

439,027. **Raincheck.** Heel splash guards. G. Martinelli, Indianapolis, Ind.

439,039. **Koro-seal.** Upholstery covers. B. F. Goodrich Co., New York, N. Y.

439,076. **Advawax.** Mixture of polybutene polymers and hydrocarbon waxes. Advance Solvents & Chemical Corp., New York, N. Y.

439,097. **Concord.** Tires and tubes. Affiliated Retreaders, Inc., New York, N. Y.

439,098. **Vanilube.** Vinyl resin stabilizing and releasing agent. R. T. Vanderbilt Co., Inc., New York, N. Y.

439,101. **Rubber Flot.** Mold Lubricants. Preventive Maintenance Co., Bridgeport, Conn.

& Co., and Pantasote Leather Co. before joining The Laurel Co. in 1924. Although not active in the concern for the past six years because of ill health, Mr. Josephson kept an interest in its affairs.

He was also president of the Passaic Library Board and a trustee of the Congregational Church and was very active in the Rotary Club and Republican organizations.

He leaves his wife, a son, a daughter, and two small granddaughters.

### William A. Corder

THE president and treasurer of L. A. Rubber & Asbestos Works, Inc., Los Angeles, Calif., William Arthur Corder, died June 20. He was stricken with meningitis on board ship during a vacation in Alaska and was flown to Vancouver, B. C., Canada, where he died without regaining consciousness.

Mr. Corder who was born in San Francisco, Calif., in 1885, began his long association with the rubber industry in 1898 when he joined the Plant Rubber & Asbestos Works in San Francisco. In 1905 he opened up the same line in Seattle, where he remained until 1910, when he joined the Los Angeles Rubber Co., which later expanded and became the L. A. Rubber & Asbestos Works, as president. He held a similar position with the Los Angeles Rubber Mfg. Co., a subsidiary, which was organized in 1935.

Mr. Corder was a member of the Jonathan Club, Bohemian Club, and Al Maiaikah.

Funeral services were held at the Little Church of the Flowers on June 26, followed by burial at Forest Lawn Memorial Park, Glendale, Calif.

Surviving Mr. Corder are his wife and a sister.

### Donald F. Cranor

WHILE on a business trip to Paris, France, after having presented a paper at the Rubber Technology Conference in London, Donald F. Cranor, an executive of the Binney & Smith Co., New York, N. Y., was stricken with a cerebral hemorrhage which caused his death on July 3. He had been in England since June.

Mr. Cranor was born in Wilmington, Del., on February 20, 1890. His long association with the rubber industry began in 1912 when he joined the Lee Tire & Rubber Co., Conshohocken, Pa., upon his graduation from the University of Pennsylvania. From his initial position as chemist he rose to technical superintendent. In 1923 he became associated with Binney & Smith Co. in its research and development department. There he set up the first research and development laboratory in the carbon black industry, and under his direction a large staff was organized for technical service to the many industries served by Binney & Smith.

The author of many papers, the deceased was well known for his knowledge of carbon black and its application to rubber. He was a member of the American Chemical Society, the American Society for Testing Materials, and the Society of the Chemical Industry.

He is survived by his wife and a son.

A memorial service was held on July 16 at "The Universal Chapel," New York. Interment took place in Plymouth Meeting Ground, Conshohocken, Pa., July 20.

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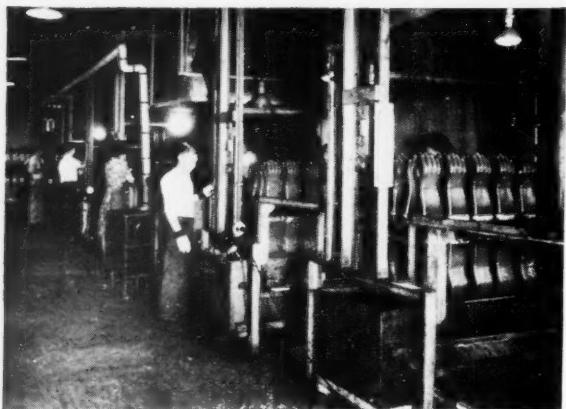
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### Stainless Steel Electric Laboratory Oven

A SERIES of new heating, baking, and drying ovens made of polished stainless steel is now available from Modern Electric Laboratory, Chicago, Ill. The smaller models of ovens are made entirely of polished stainless steel; while the largest model has stainless steel interior with an exterior of pressed steel finished with a baked-on long-wearing enamel. Uniform temperature is secured from a heavy nichrome element which covers the entire bottom area of the oven, and all six sides are insulated with Therm-O-Flake bonded block.

The inside dimensions of the ovens follow: eight by eight by eight inches in the 500-watt size; 12 by 12 by 12 inches in the 800-watt size; and 14 $\frac{1}{2}$  by 17 $\frac{1}{4}$  by 19 inches in the 1,750-watt size. All models have an extremely accurate hydraulic electric thermostat that has a response sensitivity of  $\pm 0.5^\circ$  C. An automatic timer and switch can be secured to control any set temperature within the range for any length of time from one minute to 60 minutes.

## Dynamic Properties Tester

THE Goodyear Vibrotester, a forced vibration device for measuring dynamic properties of rubber and rubber-like materials, is now available from Precision Scientific Co., Chicago, Ill. The instrument gives a prediction of heat generation and relative service temperatures in various applications of rubber and also furnishes in a general way a criterion of the rubber-like quality of the polymer and its ability to deform and recover under the action of rapidly applied forces for the service



FOR FURTHER DETAILS, SEE AD ON PAGE 600

INDIA RUBBER WORLD



Vibrotester for Measuring Dynamic Properties of Rubber

range of temperature.

The Vibrotester consists essentially of a vibrating system which includes a mass and the rubber being tested. The device is driven by electro-magnetic forces on a coil carrying alternating current of controlled frequency in the field of a powerful permanent magnet. The system is tuned to resonance by proper variations of the mass, the frequency, or both. The mass and the frequency at resonance determine the dynamic modulus; while the amplitude and the current determine the internal friction of the rubber. From these values dynamic resilience, hysteresis, and relative rates of heat generation under constant force and constant amplitude conditions can be readily obtained or calculated.



New Comet Mototruck

**T**HE Comet Mototruck, made by the Comet Mfg. Co., Minneapolis, Minn., is now in production to meet peacetime demand. Designed during the war to solve the problem of meeting increased production needs with war-trained manpower, the truck had been held in the blueprint stage because of wartime restrictions and material shortages.

The Mototruck is built along the lines of a conventional two-wheeled hand truck, but with a sturdier construction to accommodate heavier loads. It presents the advantage of a power-driven unit where there is little need of a costly three- or four-wheel power truck. The new truck provides power to spare for trucking loads up to 1,500 pounds. It has undergone years of testing and has been used for materials handling in warehouses, on transport loading docks, construction sites, airports, farmyards, and in large and small manufacturing plants.

The Mototruck has proved itself capable of moving full-capacity loads up steep inclines and over obstacles without undue strain on the operator. According to the company, the savings in time and elimination of operator fatigue made possible by this unit are such as far to outweigh its cost.

NORWAY'S IMPORTS OF RUBBER AND RUBBER GOODS INCREASED in 1947; production of rubber goods locally was reportedly above prewar level. Crude rubber imports came to 3,312 tons, and the total value of all rubber imports, to about \$6,000,000 in 1947, which compares with about \$3,800,000 in 1946. Total imports of rubber and rubber goods in 1948 are to be restricted to about two-thirds of the 1947 value, reports indicate, with the cut affecting chiefly manufactured rubber goods. It seems that though merchants put requirements of tire imports at about \$1,400,000 and of other rubber articles at \$300,000, the government's import program provides for imports of tires to a value of about \$600,000 and of other goods to only about \$100,000.

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#### Improved Roelig Hysteresis Machine on Display

Among the outstanding developments in apparatus for physical testing of rubber may be mentioned the hysteresis machine designed in Germany by H. Roelig, first described by him at the London Rubber Conference in 1938. In the intervening years the machine has been further improved, and allied rubber technologists who saw it after the war at the I. G. rubber laboratories at Leverkusen were greatly impressed by its potentialities. Consequently the Ministry of Supply arranged for I. G. to build a new machine incorporating all the improvements based on wartime experience in Germany. This machine was finally completed and recently arrived in England where it is to be installed in the laboratories of the RABRM at Croydon. All rubber technologists interested will have the opportunity of inspecting the machine there. It is understood that the apparatus is to be used on work of interest both to service and industrial organizations.

#### New Dunlop Tire

Dunlop's new tire, to be available in Fort and Standard qualities, shows a further development of the toothed pattern first introduced by Dunlop Rubber, Ltd., in 1937. In the latest tire the number of ribs is no longer limited to five, but may be six or seven, depending on the size of the tire; each pattern edge now has teeth, every fourth or fifth tooth being more prominent than the others; the knife cuts across the tread have been still further developed, and the tread pattern is deeper. The tire has a flatter tread and new buttress design. These changes are claimed to improve skid resistance by 15%; while the flatter tread gives increased average mileage of 10 to 15% as compared with the present Dunlop tire. The Fort tire also has non-static properties. Dunlop is also to introduce a new low-pressure tire which will have all these new features.

Dunlop has reported considerably increased production and sales volume during 1947, both at home and abroad, evidence of the effectiveness of the expansion plans formulated by the board as early as 1944. The consolidated operating profit of the group (excluding Germany and Japan) for the year amounted to £9,426,000, against £8,263,000 in 1946. Net profit, for 1947 was £6,728,000, an increase of £734,000 over that of the preceding year. To the net profit was added £750,000, representing a further partial refund of excess profits paid by the parent company in respect of companies formerly in enemy territories. The parent company showed a net profit of £4,652,500, which includes the £750,000 refund mentioned above. Preference dividends for 1947 amounted to £206,250, and a 12% dividend and a bonus of 3% on the ordinary stock were paid. The carry-forward came to £979,765.

#### British Rubber Industry Notes

The Third Foundation Lecture was scheduled for June 18 at Manchester, with W. J. S. Naunton speaking on "Rubber Research, Rubber Investigations, and Rubber Empiricism."

The export promotion department of the Board of Trade is reviving the Special Register Service of Information, discontinued during the war. By means of the register the department will be able to present directly to exporters information about foreign commercial conditions and trade openings, as supplied by overseas representatives.

There is unprecedented unemployment in the waterproof garment industry, the president of the Board of Trade has recently been informed. More than 700 workers out of a total force of 3,500 employed in the industry have been dismissed, and many others are working on reduced schedules. The Waterproof Garment Workers' Union has requested that coupon rates be promptly reduced, for unless something is done quickly to clear the stocks of finished goods now overflowing store rooms, losses will be incurred by the perishing of the garments.

Petrochemicals, Ltd., is completing negotiations for additional financing amounting to £2,450,000. These funds will permit considerable expansion beyond the original plans of the Catarole plant for producing chemicals from petroleum, now about to be

completed at Manchester. Certain units of the plant are expected to be operating by the end of 1948, and the entire plant, by the second half of 1949. It seems that part of the additional money provided is to be used for erecting a plant to produce styrene and polystyrene, and Ernoid, Ltd., is understood to be ready to invest up to £300,000 in this venture.

The British Industries Fair, held from May 3 to May 14, was reported to have been highly satisfactory to most exhibitors. The number of foreign buyers, about 15,000, exceeded by some 3,000 the official forecast based on preliminary reports. There were more than 2,000 exhibitors at the London section, including a large number of representatives of the rubber, plastics and chemicals industries.

At the Birmingham Section of the Fair, machinery for rubber and plastics in addition to such goods as electric cables and accessories and industrial molded and extruded rubber products were to be seen.

It is stated that before the Fair closed, there was a record number of requests for space at the 1949 Fair.

Frank Harris Cotton, lecturer in the rubber department of the Northern Polytechnic, London, and technical director of the Phoenix Rubber Co., Slough, has just received his Ph.D. degree for his thesis "The Mastication of Raw and Vulcanized Rubber and Allied Autoxidative Phenomena."

### Rubber Industry in Scotland

The Committee on the Chemical Industry of Scotland, appointed by the Scottish Council, recently completed a survey of Scotland's rubber industry, from which it emerges that nearly all branches of rubber products are made in Scotland, from automobile tires and conveyor belting to hot water bottles and rain-proof garments. The number of firms engaged in the manufacture of rubber remained substantially the same during the war, but there have been some expansions, and more are being planned.

The local industry did its own reclaiming of scrap rubber during the war, erecting the necessary plant, as was also done in England; indeed now that natural rubber is again freely available, it is suggested that there may prove to be surplus reclaiming capacity.

Most of the chemicals used in rubber compounding must be obtained from England or imported from abroad. Among chemicals produced in Scotland may be mentioned barytes and a small amount of carbon black. The report urges that Scotland, with oil shale and an established oil refining industry, make every effort to develop the production of carbon black.

At the tire factory of the North British Rubber Co. Ltd., Castle Mills, Edinburgh, Scotland, new equipment is being installed to make this factory among the most modern in Britain. Already 12 of the latest-type automatic presses for curing automobile tires have been installed; each press is capable of producing 30-40 tires in a 24-hour period. Conveyors will carry bagged raw tires from an upper floor to the lower curing department and to the proper press; another conveyor will remove finished tires to the warehouse for sorting and storage; an electric eye counts tires as they pass on the conveyor. A new-type cycle tire building machine has also been acquired, which will greatly simplify production of cycle tires.

## GERMANY

According to the German press, about 60% of the equipment of the Buna factory at Schkopau in the Russian zone was recently being removed. The remaining plant is reportedly considered adequate for covering the Buna requirements of the Eastern zone. On the other hand, manufacture of several other products, including Igelit, (polyvinyl chloride plastic) is to be expanded.

Igelit is said to be extensively used in the manufacture of footwear and other articles in the Soviet zone. It seems that works in the Bitterfeld area (near Merseburg) produce 2,000,000 pairs of Igelit shoes for children and adults annually. Furthermore, Igelit paste has for some time been used as impregnating material in making shoes from straw and soles from paper. The Leipzig firm of Ziegler & Wiegand makes raincoats and capes of Igelit; and in Berlin, Firma Para-Gummi, Erich Rossig, makes 5,000 protective masks monthly for the mining industry, both for the domestic and foreign markets. Surgical and dental goods, as well as sponges are also being made from Igelit.

A German periodical, *Nachrichten für Außenhandel* (Foreign Trade News) learns that a considerable part of the plant at the



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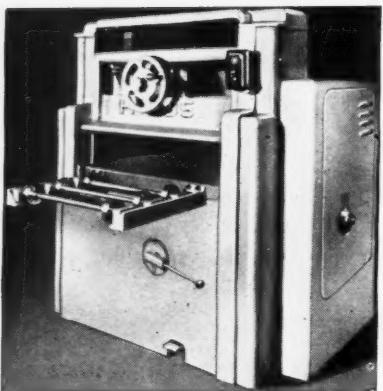
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Höchst works of the former I. G. Farbenindustrie, A.G., is being dismantled. By this measure, the productive capacity of the works will be reduced by about 50,000 tons annually, it is said, with a resulting yearly loss in products representing a total value of 25,700,000 marks, of which solvents and plastics will account for 16,800,000 marks.

Of the four works of the Continental Gummi-Werke A.G., that at Vahrenwald seems to have suffered the most under wartime bombing. A large part of this factory, however, has been restored, and at present it, together with the works at Stocken, Limmer, and Korbach-Waldeck are operating at 45% capacity. In all 10,000 persons are employed, against 17,000 to 18,000 before the war, and in 1947 production was 19,400 tons as compared with 18,500 tons in 1946. The main products were tires, conveyor belts, mechanical hose, surgical goods, and repair material, with tires accounting for 60% of the total output and including 370,000 automobile tires and 1,100,000 cycle tires.

Shortage of trained labor and reduced efficiency of workers because of the food situation are said to be important factors in preventing full use of productive capacity, but it is expected that by the end of the current year, outputs will have increased considerably. From 80 to 90% of natural rubber is now used in rubber manufacturing, a change that is welcomed as far as tires are concerned; but for other goods, especially mechanica's, Buna will continue to be preferred.

The firm, which before the war exported up to 60% of its total output, reports an increasing number of foreign orders, which for the most part cannot be filled because of the shortage of dollars. The company has nevertheless already established an export office abroad and for the first time received permission from the Bizonal authorities for a trip to America by its representatives. The concern was also recently permitted to export several thousand special snow tires to Switzerland.

The Degussa firm of Cologne, manufacturer of blacks, now produces at about 50% of the peacetime level. The increased use of natural rubber is said to be causing a shortage of blacks; productive capacity is available to cover all requirements, but cannot be fully utilized because of improper transportation facilities, shortage of labor, inadequate supply of paper bags and of textiles for filters and the like; these obstacles reportedly even threaten to force still further curtailment of operations.

The Bizonal Control Commission announced the cessation of the production of synthetic rubber in Bizonia as from June 30, 1948, a press report from Germany states.

## FRANCE

A new process for making hollow, seamless goods from natural or synthetic rubber latex has been developed by C. Saint-Mieux.<sup>1</sup> After testing a variety of plastics for use in making molds, the author discovered that only the various types of commercial polyvinyl alcohols gave positive results, being rigid, when dry, and soluble in water. Further investigations disclosed that still more interesting results could be obtained with a product formed from a solution of polyvinyl acetate of very high viscosity in hydrochloric acid, treated with solution of caustic soda. The rubber-like precipitate thus obtained, after being washed in cold water to remove excess caustic soda and dissolved in boiling water, yielded sheets which, when dry, were hard, soluble in boiling water, but insoluble in cold water, which, however, the material could absorb rapidly, when it swelled and became flexible and elastic. Such water-swollen sheets could be dried again in hot air, when they regained their original rigidity, and the process could be repeated a great many times. The Soc. Someca, which is licensed to manufacture this material, sells it under the trade name of Neovyl, either as a solid or as a 10% solution.

Molds of either Neovyl or polyvinyl alcohols can be made by cutting with shears or a punch the desired shape in the proper internal dimensions from a dry sheet one to two millimeters thick. The sheets stored at ambient temperature contain 8-10% of hydroscopic moisture so that in cutting out, shrinkage of about 6% must be allowed for. The shape is rapidly dried at 60° C., repolymerized, and allowed to cool again. If the article to be formed is to have interior walls, as in air mattresses, slits two millimeters wide are made in the shape before or after repolymerization. The mold thus made is provided at one end with a little tubular opening about 20 millimeters wide and 10 centimeters long, which is perforated in one or two places. Small articles can be dipped 10 to 20 at a time; larger ones, as air cushions, beach toys, etc., one at a time, preferably by hand. The edges of the mold, tube, and slits are quickly swabbed with an aqueous solution of calcium chloride; then the mold is

<sup>1</sup> Rev. gén., caoutchouc, 25, 6, 214 (1948).

plunged into a latex bath, next into a calcium chloride bath, and finally into the bath of vulcanized latex for two to five minutes, depending on the thickness of the article. If the article is still not thick enough, it is dipped into the coagulant again and once more into the latex bath and allowed to dry.

To unmold, cold water is forced into the interior of the article via the tube, thereby loosening the rubber walls from the synthetic resin. The water is allowed to remain in the article for 12-24 hours; if a polyvinyl alcohol mold has been used, it has been partly dissolved by the cold water at the end of this time, and the remainder is easily removed with the aid of hot water. A Neovyl mold in the same time has become gelatinous, but not sticky, and can be removed unimpaired with a suitable tool via the distended tubular opening. Dried and flattened, the mold can be used over and over again.

The materials can also be used as mold cores instead of metal mandrels.

Among the advantages claimed for the use of these materials are that the most complicated shapes can be made easily and inexpensively; the articles are obtained at reasonable cost; they are flat, light in weight, and take up little space. The materials are particularly useful in facilitating the manufacture of hollow goods with very small openings, a difficult if not impossible process with metal mandrels.

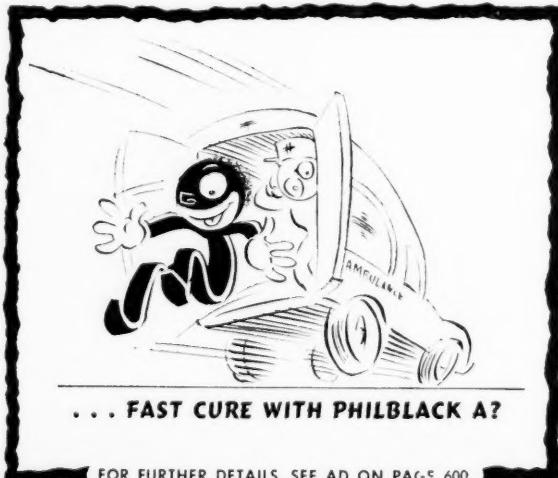
## TURKEY

Turkey's imports of crude rubber in 1946 decreased slightly from the 1938 level, but imports of rubber manufactures, especially mechanical goods, increased substantially, a British official report indicates. In 1946 the country imported 317 tons of crude rubber, against 338 tons in 1938; imports of rubber sheets, slabs, rings, piping, and belting totaled 715 tons, against 172 tons, and tires and tubes, 1,114 tons, against 928 tons.

While more than half of the 1938 mechanical goods came from Germany, with the United States a poor second, closely followed by Hungary and Italy, and the United Kingdom was represented by only four tons the United States supplied more than 88% of the total in 1946, and the United Kingdom almost all of the remainder.

Of the 1946 imports of tires and tubes, the United States supplied 596 tons, Portugal 208 tons, United Kingdom 128 tons, India 112 tons, and France 40 tons. In 1938 the United States sent 344 tons, Italy 266 tons, Germany 135 tons, United Kingdom 78 tons, France 43 tons, and the U.S.S.R. 16 tons.

"The Uses of Hevea for Food in Relation to Its Domestification," Russell J. Seibert. Reprinted from *Annals of the Missouri Botanical Garden*, 35, 117-121 (May, 1948), 6 pages. This paper discusses the domestication and use as a food source of certain varieties of *Hevea* in South America, Central America, and the West Indies.



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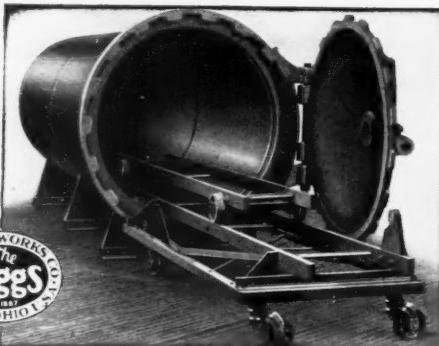


Fig. 18. Vulcanizer with inside car and outside transfer truck. Built to meet customers' requirements; all sizes.

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## Editor's Book Table

### BOOK REVIEWS

**"SPI Handbook."** The Society of the Plastics Industry, Inc., 295 Madison Ave., New York 17, N. Y. Cloth, 9 by 6 inches, 451 pages. Price, \$7.50 to non-members; additional copies to members, \$4.50.

A comprehensive and factual presentation of data on plastic materials and their molding and fabricating, this handbook will take its place as the authoritative work on the plastics industry, comparable to the position occupied by the SAE handbook in the automotive field. While mainly concerned with molding and fabricating techniques, the plastics book has a section containing a new classification of plastic materials by code numbers which should be of special interest to those concerned with specifications and the selection of materials.

Individual chapters cover classification of plastics molding materials; molding and forming plastics parts; design of molded articles; design standards for inserts; standards for tolerances on molded plastics parts; cementing and assembly of plastics; testing plastics parts; mold design and recommended steels; machining and finishing plastics parts; and laminated products and their fabrication. The inclusion of more than 500 charts and illustrations adds to the value of the book, which will be revised periodically to keep pace with new developments.

**"High-Speed Mathematics."** Lester Meyers. D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y. Cloth, 8 by 5½ inches, 574 pages. Price, \$5.95.

An interesting, relatively simple, and comprehensive course in number visualization is given in this book. All methods known for high-speed mathematical calculation are presented in a systematic organization, illustrated by numerous fully worked sample problems. As an aid to learning, typical problems and their answers are appended to each chapter. Further interest is derived from the sample problems worked out in the text because they are drawn from almost every field of business and science. The book should achieve its aim of providing greater speed, accuracy, and confidence with figures.

**"Industrial Experimentation."** K. A. Brownlee. Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. Cloth, 9 by 6 inches, 151 pages. Price, \$3.75.

This monograph, intended as a guide to modern statistical methods in industrial experimentation, is based on a memorandum originally prepared for the use of chemical manufacturing personnel in British Royal Ordnance factories. Following two chapters on definition and description, succeeding chapters cover significance of means, comparison of variances, the  $\chi^2$  test, the Poisson distribution, analysis of variance, quality control chart, relation between two variables, multiple correlation, general analysis of variance and miscellaneous aspects, balanced incomplete blocks, the problem of restricted block size in factorial experiments, and general conclusions.

The author has achieved a book of instructions for setting up and analyzing specific instructions, but, because of great compression and condensation, the volume falls short of providing the student with satisfactory comprehension of the subject. As an adjunct to a more theoretical treatise, the book should be valuable for its emphasis on chemical problems despite its other disadvantages which include an uncritical presentation of available methods, the omission of certain treatments and methods, and the lack of an index.

**"The Welding of Plastics."** G. Haim and H. P. Zade. Crosby Lockwood & Son, Ltd., 39 Thurloe St., London, S.W.7, England. Cloth, 8½ by 5½ inches, 220 pages. Price, 21/-.

This is a complete survey of the theory and practice of welding as applied to plastic materials up through 1945. A comprehensive description and discussion are given of each method, together with a good deal of the authors' original work. After introductory chapters on the chemistry, properties, and technology of weldable plastics, the purpose and limitations of plastics welding are discussed, and subsequent chapters cover hot gas welding, heated tool welding, high-frequency heating and welding, other welding processes, seam welding machines, industrial applications, and the training of welders. Appendices include a discussion of high-frequency welding of glass, a glossary of

terms, identification tests for thermoplastics, trade names of commercial thermoplastics, and patent, company, and subject indices. Although some of the subject matter has become outmoded in the light of recent developments, the book presents an interesting and comprehensive history of plastics welding, with emphasis on British and German work.

## NEW PUBLICATIONS

Bulletins of John Robertson Co., 121-137 Water St., Brooklyn 1, N. Y. "Robertson Engineered Cable Lead Encasing Equipment," 4 pages. "Robertson Engineered Lead Pipe Extrusion Equipment," 4 pages. "Robertson Engineered Hydraulic Pump," 4 pages. "Robertson Engineered Hydro-Pneumatic Accumulator," 4 pages. These illustrated bulletins describe the respective machines and give full information on their use, including specifications, dimensions, and capacities.

"Let's Get Acquainted!" J. M. Huber Corp., 620 62nd St., Brooklyn 20, N. Y. 12 pages. This attractive booklet illustrated with drawings, is intended to acquaint salesmen and customers visiting the Huber purchasing offices with the company's operations and policies. Information is given on the company's clay, carbon black, printing inks, oil and gas, and industrial products divisions.

Publications of General Electric Co., Pittsfield, Mass. "Chemical Department Products." Booklet No. CDP-576. 18 pages. This illustrated booklet briefly describes the products made by the plastics, resin and insulation materials, metallurgy, and compound divisions of the chemical department, together with their industrial applications. "Silicones." Bulletin No. CDR-57. 30 pages. Detailed descriptions are given of the company's silicone materials, including resins, oils, greases, water repellents, and rubber. Industrial applications are mentioned, and technical charts and tables on the silicone materials are included.

"G-E Plastics—Molded, Laminated." Bulletin No. CDP-578. 16 pages. This illustrated bulletin describes the design, mold making, and molding facilities of the plastics division, discusses the uses of the company's different molded and laminated plastics and silicone rubber, and gives extensive tables of properties of the different materials.

"Baldwin Stress-Strain Recorders and Strain Followers." Bulletin 262. Baldwin Locomotive Works, Philadelphia 42, Pa. 32 pages. The bulletin illustrates and describes the basic principles of Baldwin recorders, and the features of the different recorders, and offers information on accessory equipment, including extensometers, compressometers, deflectometers, and strain gages.

"Indonex Plasticizers with Various Fillers in Natural Rubber Stocks." Circular No. 13-25, July 1, 1948. Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Ill. 6 pages. Laboratory test data are presented comparing SRF black, Calcene, whiting, clay, and Thermax in different types of natural rubber stocks containing Indonex 638 $\frac{1}{2}$  plasticizer. Natural rubber stocks containing reclaim are included in the comparison, and it is shown that a wide variety of mechanical goods compounds can be formulated with substantial cost advantages.

"Dow Corning Silicone Mold Release Agents." Dow Corning Corp., Midland, Mich. 16 pages. The company's silicone mold lubricants are described, and detailed information, with photographs, given on their use for tire molds, curing bags, tire bead and parting line, mechanical goods, soles and heels, floor tile, and plastic products. Brief descriptions of other silicone products are also included.

"Unicel S." L. S. Baker. Report No. 48-2, June, 1948. E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 8 pages. Unicel S, a new sponge blowing agent containing finely divided sodium bicarbonate, is described and compared with ordinary sodium bicarbonate. Because of its fine particle size, Unicel S is more than five times as efficient as ordinary sodium bicarbonate and produces smaller and more uniform cells in sponge.



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"Synvar Resins for Rubber Compounds, Cements, and  
Latices." Synvar Corp., Wilmington 99, Del. 8 pages. This  
bulletin presents instructions on the use of the Synvarite RC  
series phenolic resins in rubber compounding. The individual  
resins of the series are described, and information and test  
data appear on their use in GR-S, nitrile, neoprene, and natural  
rubber compounds, latices, and rubber cements.

Bulletins of Carbide & Carbon Chemicals Corp., 30 E. 42nd  
St., New York 17, N. Y. "Flexol Plasticizer R-1," Form  
F-7142, May 1, 1948, 4 pages. "Flexol Plasticizer TWS,"  
Form F-7141, May, 1948, 4 pages. Each bulletin gives informa-  
tion on the properties of the individual plasticizers, their  
compatibility with various resins, their relative performances in  
Vinylite resin, procedures in compounding, mixing, and making  
vinyl resin dispersions, and their applications.

"Control Valves." The Sinclair-Collins Valve Co., 454 Morgan  
Ave., Akron 11, O. 20 pages. This catalog illustrates the  
design and assembly of the company's line of direct and reverse  
acting control valves and gives parts lists and overall dimensions  
for the valves. Valve capacity charts for steam, liquids, and  
gases are also included, together with a table of maximum  
working pressure ratings for valves with zero back pressure in  
the line.

"Bausch & Lomb Photomicrographic Equipment, Model L,"  
Catalog E-210, Bausch & Lomb Optical Co., Rochester 2, N. Y.  
24 pages. "Yale Load King Scales—Poised for Accuracy."  
The Yale & Towne Mfg. Co., Philadelphia 24, Pa. 68 pages.  
"Solving Industrial Crimes, Case No. 1," The Esterline-Angus  
Co., Indianapolis, Ind. 12 pages. "Permanent Magnets, Per-  
manent Magnet Assemblies, Other Metallurgical Products,"  
General Electric Co., Pittsfield, Mass. 8 pages. "Yarway Doffs  
Its Hat to Stetson," *Yarway News*, Vol. 3, No. 3. Yarnall-  
Waring Co., Chestnut Hill, Philadelphia 18, Pa. 8 pages.  
"Reeves Speed Control," Reeves Pulley Co., Columbus, Ind.  
12 pages. "All Hydraulic Self-Contained Injection Molding  
Machines," Bulletin 4802, The Hydraulic Press Mfg. Co.,  
Mount Gilead, O. 6 pages. "Chromolax Electric Radiant  
Heaters for Glassless Infra-Red Drying, Baking, Heating,"  
Edwin L. Wiegand Co., Pittsburgh 8, Pa. 4 pages. "Milton  
Roy Pumps," Bulletin No. 484, Milton Roy Co., Chestnut  
Hill, Philadelphia 18, Pa. 4 pages.

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# Market Reviews

## CRUDE RUBBER

### New York Outside Market

#### WEEK-END CLOSING PRICES

	May	June	July	July	July	July
No. 1 R.S.S.	29	26	3	10	17	24
July	22.25	22.50	23.00	23.38	24.13	24.88
Aug.-Sept.	22.25	22.50	23.00	23.50	24.00	24.75
Oct.-Dec.	22.38	23.00	23.25	23.88	24.63	
Jan.-Mar.				23.38	24.00	
Apr.-June				23.13	23.75	
No. 3 R.S.S.						
(spot)	21.00	21.00	21.38	21.50	21.63	22.00
No. 2 Brown						
(spot)	18.00	18.00	18.25	18.25	18.25	18.50
Flat Bark						
(spot)	12.50	12.00	12.38	12.25	12.25	12.25

**N**O CHANGE was reported during July by rubber dealers in the New York Outside Market in the dull factory interest in physical stocks which has been a market factor for some months now. Dealers anticipate that this condition will continue for a while longer, perhaps until the international situation is clarified.

Despite the dullness of the market and the low volume of trading, prices in the physical market rose during July following the lead of the Commodity Exchange and foreign markets. The spot price for No. 1 Ribbed Smoked Sheet, which began the month at 22.75¢ reached the high for the year of 25.00¢ on July 26 and 27, the last days of trading. In general, buyers had lower price ideas, but some agreements were reached intermittently.

No. 3 Smoked Sheet prices also rose during the month, starting at 21.25¢ on July 1, reaching the high of 22.38¢ on July 19, and closing the month at 22.25¢. Prices for No. 2 Brown and Flat Bark showed little change during the month. No. 2 Brown fluctuated irregularly between 18.00¢ and 18.75¢; while Flat Bark moved in the 12.00-12.50¢ range.

### Commodity Exchange

#### WEEK-END CLOSING PRICES

	May	June	July	July	July	July
Futures	29	26	3	10	17	24
July	21.85	21.68	22.25	22.25	22.43	22.75
Aug.	21.75	21.78	22.30	22.32	22.47	22.75
Sept.	21.65	21.85	22.35	22.45	22.50	22.75
Oct.	21.60	21.85	22.35	22.42	22.55	22.74
Nov.	21.55	21.85	22.35	22.42	22.55	22.74
Dec.	21.45	21.88	22.35	22.45	22.60	22.74
1949						
Jan.	21.40	21.73	22.20	22.42	22.55	22.71
Feb.	21.35	21.60	22.15	22.42	22.50	22.71
Mar.	21.30	21.47	22.10	22.40	22.45	22.69
Apr.	21.25	21.32	22.05	22.37	22.42	22.66
May	21.25	21.18	22.07	22.35	22.40	22.64
June	21.20	21.10	22.05	22.30	22.37	22.61
July	21.20	21.05	22.00	22.25	22.35	22.59
Aug.	21.20	21.00	21.95	22.20	22.32	22.56
Sept.			21.90	22.15	22.30	22.54

**T**HE unsettled international crisis failed to arouse significant trading volume in rubber futures on the Commodity Exchange during July. Real speculative interest is lacking as yet, and most market observers are at a loss to explain why the Russo-American crisis is not attracting more interest in rubber futures. Most observers feel that trade volume should increase noticeably during the next month. The international situation had a strong effect on the Singapore and London markets, however, and the firmness of these markets served as the basis for advances in prices on the Exchange.

The total volume of sales on the Exchange during July was 11,040 tons, the lowest of the year. This trading was confined mainly inside the trade, with other buyers still cautious about taking futures positions. In addition to the international situation which seems to have aroused an attitude of watchful waiting, dealers reported that another explanation for the low volume of futures trading is to be found in the rubber futures standard contract which they find unsatisfactory. The Exchange is said to be considering proposals for a new form of contract.

The easiness of rubber futures reflected in part the strong British police action in Malaya which has reduced fears of any serious interruption of rubber production or distribution in the Far East. Reports received late in the month revealed that despite civil disturbances in the Malayan Federation rubber production there was increased by 11,000 tons in June. Official figures put June production at 60,594 tons, 33,246 of which came from estates, while the remaining 27,348 tons came from small-holders. It is apparent from these figures that the terroristic outbreaks in Malaya are not reducing rubber production to date.

Despite the low level of trade, prices for rubber futures moved irregularly higher on the Exchange during July, following the London and Singapore markets. July prices began at 22.05¢ on July 1, reached a peak of 23.00¢ on July 19, and closed at 22.85¢ on July 27, the last day on the board. December futures started the month at 22.20¢, and reached a high of 23.05¢ on July 30.

### Latices

**P**RODUCTION of *Hevea* latex in Malaya is reported to be greatly reduced as compared with late 1947 and early 1948 rates. According to Arthur Nolan, Latex Distributors, Inc., writing in Lockwood's July *Rubber Report*, factors influencing this drop-off include the unexpected slow absorption rate and very large stocks in the United States, the rising solid rubber prices, and the May latex price reduction which made latex production uneconomical for certain producers. There is no indication as yet that disturbances in Malaya have been a cause of this lower latex production. Except for shipments of experimental samples and parcels of special-purpose latices, the shipment of drummed lates from Malaya has practically ceased because of the prohibitive cost of steel drums there.

Mr. Nolan gives May imports of *Hevea* latex as 3,442 long tons, dry weight, and consumption as 1,865 long tons, dry weight. This consumption figure was the lowest in 1948 since the short month of February. End of May stocks of *Hevea* latex were 9,803 long tons, dry weight, the highest level since 1942, when stocks had been accumulated for war use. Demand for *Hevea* latex elsewhere in the world has also fallen off. This slackening can be attributed to financial and exchange problems and to general commercial inactivity pending the effects of ERP.

Production of GR-S latex was 1,842 long tons, dry weight, in May and is estimated at 1,495 long tons, dry weight, in June.

This June figure is the lowest since January, 1940, when production of GR-S latex was starting its rise to reach a peak of 2,625 tons in June, 1940. The prices of both *Hevea* and GR-S latices remained unchanged during July.

### Fixed Government Prices\*

#### Guayule

Guayule (carload lots) ..... \$0.17 1/2

#### Latex†

<i>Hevea</i> , normal (tank car lots)	.30 1/4
Centrifuged (tank car lots)	.32 1/2
GR-S, Type 2 (tank car lots)	.18 1/2 ‡
(Carload, drums)	.27 3
(Less carload, drums)	.18 1/2 ‡
Types 3 and 4 (tank car lots)	.26
(Carload, drums)	.26
Type 5 (tank car lots)	.20 1/2 ‡
(Carload, drums)	.27 3
(Less carload, drums)	.27 3

#### Plantation Grades

No. 1X Ribbed Smoked Sheets ..... .23

1X Thick Pale Latex Crepe ..... .29

1 Thick Pale Latex Crepe ..... .29

2 Thick Pale Latex Crepe ..... .28 1/2

3 Thick Pale Latex Crepe ..... .28 3/4

1X Thin Pale Latex Crepe ..... .29

1 Thin Pale Latex Crepe ..... .29

2 Thin Pale Latex Crepe ..... .28 1/2

3 Thin Pale Latex Crepe ..... .28 1/2

Liberian A ..... .28 1/2

AA ..... .29

RCMA Watermarked Crepe No. 16 ..... .37 1/2

17 ..... .32 1/2

18 ..... .30 1/2

Sole Crepe Trimmings ..... .28 1/2

No. 1X Thin Pale Latex Crepe Trimmings ..... .28 1/2

1X Brown Crepe ..... .21 1/2

2X Brown Crepe ..... .21 1/2

2 Remilled Blankets (Amber) ..... .21 1/2

3 Remilled Blankets (Amber) ..... .21 1/2

Rolled Brown ..... .18 1/2

#### Synthetic Rubber

GR-M (Neoprene GN) ..... .32

GR-M-10 (Neoprene GN-A) ..... .32

GR-S (Buna S) ..... .18 1/2

GR-I (Butyl) ..... .18 1/2

#### Wild Rubber

Upriver Coarse (crude) ..... .12 5/8

(Washed and dried) ..... .20 1/4

Islands Fine (crude) ..... .14 5/8

(Washed and dried) ..... .22 1/2

Caucho Ball (crude) ..... .11 5/8

(Washed and dried) ..... .19 1/2

Mangabiera (crude) ..... .08 1/2

(Washed and dried) ..... .18

\* For a complete list of all grades of dry rubbers see Rubber Reserve Co. General Sales and Distribution Circular, July 1, 1945, as amended.

† Prices per pound total solids.  
‡ Plus average freight charge of 0.75¢ per pound dry weight.

### SCRAP RUBBER

**A**N UNDERTONE of easiness was evident in the scrap rubber market during July, especially in the latter part of the month. Some reclaiming mills were on vacation during the first fortnight of the month and then resumed operations. This activity was counteracted by the closing down of other mills for the last two weeks in July, and, as a result, the industry as a whole was still operating on a curtailed basis.

Foreign business was slow, but dealers reported that demand abroad is good and should result in good business once the Joint Import-Export Agency commences to buy scrap rubber. There is no news as yet as to when the Agency will begin purchasing. It had been thought originally that these purchases would commence early in July, but the confusion brought about by the recent currency reform in Allied-occupied Germany served to delay action.

The only changes in scrap rubber prices

Janu-  
S la-  
peak  
prices  
ained

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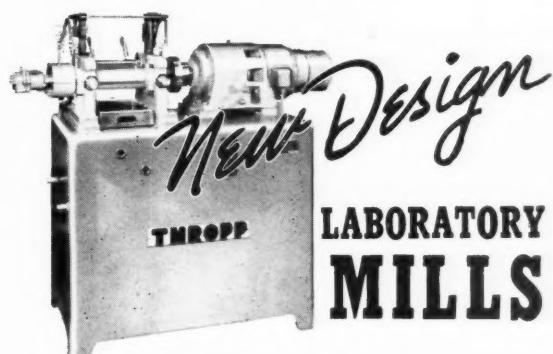
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that occurred in July were for mixed auto tires which rose from \$12 to \$12.50 per net ton in the East, and from \$12.50 to \$13 per net ton in Akron. Some interest was noted in auto tubes, particularly red tubes, but this did not result in price changes. The rest of the market remained sluggish.

Following are dealers' buying prices for scrap rubber, in carload lots, delivered to mills at points indicated:

	Eastern Akron, Points O. (Per Net Ton)
Mixed auto tires	\$12.50
S.A.G. passenger (natural)	nom. nom.
Truck (natural)	nom. nom.
Peelings (natural), No. 1	50.00
No. 2	31.00
No. 3	29.00
	(¢ per lb.)
Mixed auto tubes	4.00
Red passenger tubes	6.75
Black passenger tubes	5.00
Truck tubes	4.75
Mixed puncture-proof tubes	6.50
Air brake hose	nom. nom.

## RECLAIMED RUBBER

THE reclaimed rubber market last month showed no change from June. The slight increase in domestic demand noted in June continued to be felt; production of reclaim remained at a high level, and exports were again at moderate levels.

Final April and preliminary May statistics on the reclaimed rubber industry are now available. Production of reclaim during April totaled 21,802 long tons; consumption, 22,322 long tons; exports, 1,049 long tons; and month-end stocks, 37,946 long tons. Preliminary figures for May show a production of 21,195 long tons; consumption, 22,188 long tons; exports, 1,000 tons; and end-of-month stocks, 36,885 long tons.

No changes in reclaimed rubber prices occurred during July.

### Reclaimed Rubber Prices

	Sp. Gr.	¢ per lb.
Whole tire	1.18-1.20	8 / 8.5
Peel	1.18-1.20	9 / 9.5
Inner tube		
Black	1.20-1.22	12.75 / 13.25
Red	1.20-1.22	13.5 / 14
GR-S	1.18-1.20	9.5 / 10
Butyl	1.16-1.18	8.5 / 9
Shoe	1.50-1.52	8.25 / 8.75

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

## COTTON AND FABRICS

### NEW YORK COTTON EXCHANGE WEEK-END CLOSING PRICES

	May	June	July	July	July	July
Futures	29	26	3	10	17	24
Sept.	34.82	33.80	33.41	33.03	32.72	32.97
Nov.	33.84	32.73	32.39	32.12	32.14	32.23
1949						
Mar.	32.73	32.38	32.14	32.01	32.08	32.13
May	32.42	32.21	32.00	31.88	31.98	31.98
July	31.70	31.90	31.58	31.42	31.46	31.53
Oct.	29.15	29.88	29.60	29.49	29.53	29.65

COTTON trading was dull and listless on the New York Cotton Exchange during July. Prices declined fairly steadily

during the month in the face of a strong bearish sentiment. A major reason for the pessimistic attitude was the fear that the government crop report, due August 9, will run to at least 13 million bales. This production, plus the expected 1947-1948 carryover of approximately 2.8 million bales, will give a total supply next year of about 16 million bales.

Another factor has been the position of ECA in staying off the market until new crop cotton is sufficiently available to make purchases possible without squeezing the local markets. This plan is apparently also being followed by the mills, which seem willing to hold off the market and let cotton sink to the loan level before covering their commitments. The new cotton parity figures will be released soon, but the trade expects a loan parity of about 31.24¢, a rise of about 12 points.

With these downward elements pressing on the market which is, in addition, in the middle of the regular between-seasons lag, July market activity was at very low levels. Analysts do not predict any sudden sharp upswing in activity until after the crop estimate is released.

The 15 1/2 inch middling spot price on July 1 was 30.65¢, the high for the month. Thereafter the price dropped steadily, with shortlived interruptions, and reached the low of 23.50¢ on July 30, the final day of trading. October futures prices showed the same downward trend, although to a lesser degree. The futures price was 32.65¢ on July 1 and closed the month at 32.07¢.

### Fabrics

Following a period of listless selling, some categories of wide industrial gray goods moved actively during the latter part of July. The total volume of these sales was no more than moderate, but represented a great change from the dullness of previous weeks. Chafer fabrics sold actively for forward delivery through August and September. Wide enameling ducks moved in third-quarter sales in strong contrast to most of the narrow ducks which remained quiet.

Hose and belting ducks were moved moderately and were priced at 68¢. All wide and numbered ducks were priced at 39¢ off the list price by most producers, but one large mill was quoting prices 40¢ off the list. It was believed likely that other houses will follow suit and sell their wide and enameling ducks at this 40¢ discount. Print cloths showed strong

activity toward the end of July for delivery as far ahead as the fourth quarter, with the 39-inch 80x80 4.00-yard construction most in demand.

Drills and twills had a renewal of activity with interest centered in the 37-inch 68x40 2.75-yard construction, which was quoted at 26 1/2-27¢. In sheetings, moderate interest was displayed, particularly by the bag trade in the 40-inch 48x44 3.75-yard construction. The Osnaburg market was generally quiet throughout the month, with little interest displayed by the rubber industry.

## RAYON

DOMESTIC shipments of rayon during June totaled 90,700,000 pounds, equaling the May figure and 27% above that for June, 1947. Domestic deliveries of rayon for the first half of 1948 reached 535,400,000 pounds, 18% greater than the comparable 1947 period. Rayon filament yarn shipments during June amounted to 68,300,000 pounds and consisted of 45,000,000 pounds of viscose and cupra and 23,300,000 pounds of acetate yarn.

First-quarter 1948 production of tire cord and fabric rose to 149,000,000 pounds, 2% above the previous quarter. Of this total, 51,000,000 pounds were rayon and nylon fabric and cord, and the remainder was cotton tire fabric and cord. Rayon and nylon cord and fabric production in the first quarter this year was slightly under the October-December, 1947, period, but 7% above the first-quarter 1947 output. Cotton cord and fabric showed a gain of 4,000,000 pounds over the total during the last quarter of 1947.

Current prices for high-tenacity rayon tire yarns and fabrics are listed below:

### Rayon Fabrics

Tire Yarns			
1100/380			\$0.55
1100/490			.55
1150/490			.55
1650/720			.52 / .54
1650/980			.54
1900/980			.54
2200/960			.53
2200/980			.53
Tire Fabrics:			
1100/490/2			.69
1650/980/2			.665 / .68
2200/980/2			.65

### United States Rubber Statistics—April, 1948

(All Figures in Long Tons, Dry Weight)

	New Supply			Distribution		
	Production	Imports	Total	Consumption	Exports	Stocks
Natural rubber, total	0	*38,664	38,664	48,707	343	115,016
Natural latex, total	0	2,283	2,283	1,909	0	8,232
Natural rubber and latex, total	0	40,947	40,947	50,616	343	123,248
Synthetic rubber, total	\$39,656	0	40,846	34,632	563	78,759
	21,190					
GR-S.....	\$33,653	0	33,968	26,853	48	*57,687
	3135					
Butyl.....	\$3,519	0	3,519	4,514	10	13,449
Neoprene.....	\$2,484	0	2,484	2,780	474	5,244
	7600					
Nitrile.....	\$266	0	266	485	31	2,379
Natural rubber and latex, and synthetic rubber, total	40,816	40,947	81,793	85,248	906	202,007
Reclaimed rubber, total	21,802	0	21,802	22,322	1,049	37,946
GRAND TOTALS.....	62,648	40,947	103,595	107,570	1,955	239,953

\* Includes adjustment of +200 tons applicable to February.

† Government plant production.

‡ Private plant production.

§ Includes 37 tons shipped for export, but not cleared.

SOURCE: Rubber Division, ODC, United States Department of Commerce, Washington, D. C.

# VULCANIZED VEGETABLE OILS

—RUBBER SUBSTITUTES—

Types, grades and blends for every purpose, wherever Vulcanized Vegetable Oils can be used in production of Rubber Goods—be they Synthetic, Natural, or Reclaimed.

A LONG ESTABLISHED AND PROVEN PRODUCT



Represented by:  
**HARWICK STANDARD CHEMICAL CO.**

Akron — Boston — Trenton — Chicago — Denver — Los Angeles

Regular and Special Constructions

of

# COTTON FABRICS

Single Filling

Double Filling

and

## ARMY

# Ducks

## HOSE and BELTING

# Ducks

# Drills

Selected

# Osnaburgs

# Curran & Barry

320 BROADWAY  
NEW YORK

## U. S. Imports, Exports, and Reexports of Crude and Manufactured Rubber

### Exports of Domestic Merchandise

March, 1948

UNMANUFACTURED, Lbs.	Quantity	Value
Chicle	38,078	\$20,450
Balata	2,100	8,400
Synthetic rubber: GR-S	17,735	4,588
Butyl	6,719	1,924
Nitrene	782,890	260,803
"Thickole"	48,358	19,809
Polyisobutylene	496	422
Other	2,506	802
Reclaimed rubber	2,097,781	160,990
Scrap rubber	6,385,796	187,114
TOTALS	9,390,099	\$668,648

### MANUFACTURED

Rubber cement	gals.	41,211	\$61,142
Rubberized fabric: auto cloth	sq. yds.	127,189	65,162
Piece goods and hospital sheeting	sq. yds.	40,124	35,460
Rubber footwear: boots	prs.	52,766	157,843
Shoes	prs.	48,330	70,020
Rubber-soled canvas shoes	prs.	82,414	132,094
Soles	doz. prs.	55,986	79,625
Heels	doz. prs.	65,949	54,258
Rubber soling and topstitch sheets	lbs.	236,000	64,430
Rubber gloves and mittens	doz. prs.	10,723	28,468
Drug sundries: water bottles and fountain syringes, no. Other		43,295	25,589
Rubber and rubberized clothing		300,971	
Balloons		102,166	
Bands	lbs.	60,309	
Toys and balls	lbs.	8,619	6,495
Bathing caps	doz.	2,377	9,134
Erasers	lbs.	24,063	21,511
Hard rubber goods: battery boxes	lbs.	44,723	55,151
Other electrical goods	lbs.	149,033	50,883
Comb finished	doz.	9,593	7,837
Other products			24,114
Tire casings: bus and truck	nos.	103,523	4,464,617
Inner tubes, auto	nos.	57,274	733,630
Other casings and tubes, except auto	nos.	126,097	442,976
Solid tires, auto and truck	nos.	49,191	534,210
Other	nos.	27,743	989,776
Tire repair materials: camberback	lbs.	52,156	13,799
Other			115,394
Mats, flooring, tiling	lbs.	660,002	155,619
Threads: bare	lbs.	22,321	31,129
Textile covered	lbs.	11,526	22,048
Gutta percha manufacturers	lbs.	6,902	6,983
Latex and other compounded rubber for further manufacture	lbs.	346,895	128,259
Other rubber products			344,932
TOTALS		\$11,459,312	

### GRAND TOTALS

ALL RUBBER EXPORTS

Quantity	Value
Rubber toys, other than balloons	399
Hard rubber products	5,276
Rubberized printing blankets	1,062
Rubber and cotton packing	2,433
Gaskets and valve packing	288
Belting	344
Hose and tubing	638
Other rubber products	100
Synthetic rubber products	187
Soft rubber products, other than drug sundries	455
TOTALS	8,199

GRAND TOTALS  
ALL RUBBER IMPORTS

UNMANUFACTURED, Lbs.	Crude rubber	1,045,138	\$215,156
Rubber gloves and mittens	doz. prs.	30	\$83
Drug sundries, other than syringes and hot water bottles		5,835	
Rubber toys and balls	lbs.	592	
And balata belting	lbs.	13,997	13,601
Other rubber products			5,045
TOTALS			\$25,136

GRAND TOTALS  
ALL RUBBER REEXPORTS

SOURCE: Bureau of Census, United States Department of Commerce, Washington, D. C.

## Compounding Ingredients—Price Changes and Additions

Accelerators, Organic	Butasian	Mapico	Red	White
Ethasan	lbs.	\$1,00		
Ethyl Thimrad	lbs.	1,00		
Mertax	lbs.	.37	/ \$0.44	
Methasan	lbs.	1,00		
Mono Thimrad	lbs.	1.10		
Thimrad	lbs.	1.10		

TOTALS

ALL RUBBER REEXPORTS

## Estimated Automotive Pneumatic Casings and Tube Shipments, Production, and Inventory—May-April 1948; First Five Months 1948, 1947

1948

	% of Change from Preceding Month	First Five Months	1947, First Five Months
Shipments			
Original equipment	1,372,975	1,764,982	8,441,330
Replacement	3,698,167	4,032,109	15,529,737
Export	38,502	54,535	299,360
TOTAL	5,109,644	12,68	24,70,427
Production	5,719,740	+6.46	28,306,724
Inventory end of month	9,448,439	+6.66	9,448,439

### Passenger Casings

Shipments	May	April	1947, First Five Months
Original equipment	1,372,975	1,764,982	8,441,330
Replacement	3,698,167	4,032,109	15,529,737
Export	38,502	54,535	299,360
TOTAL	5,109,644	12,68	24,70,427
Production	5,719,740	+6.46	28,306,724
Inventory end of month	9,448,439	+6.66	9,448,439

### Total Automotive Casings

Shipments	May	April	1947, First Five Months
Original equipment	1,818,226	2,264,916	10,798,251
Replacement	4,300,893	4,631,598	18,435,597
Export	135,299	142,052	787,149
TOTAL	6,254,415	-11.14	31,244,757
Production	6,930,793	+5.43	6,573,734
Inventory end of month	11,611,108	+6.13	10,940,283

### Passenger and Truck and Bus Tubes

Shipments	May	April	1947, First Five Months
Original equipment	1,813,707	2,264,095	10,785,988
Replacement	3,516,392	3,455,577	14,830,558
Export	89,095	86,870	454,944
TOTAL	5,419,194	-6.67	26,071,490
Production	5,701,812	+2.21	5,578,459
Inventory end of month	10,068,828	+3.41	9,737,206

NOTE: Cumulative data on this report include adjustments made in prior months.

SOURCE: The Rubber Manufacturers Association, Inc.

## Accelerator-Activators, Organic

Guanital	lbs.	\$0.47	/ \$0.54
Laurex	lbs.	.52	/ .55
Ridacto	lbs.	.22	/ .24

## Antioxidants

AgeRite Gel	lbs.	.58	/ .60
H.P.	lbs.	.61	/ .63
Hipar	lbs.	.82	/ .84
Powder	lbs.	.46	/ .48
Resin	lbs.	.63	/ .65
D	lbs.	.46	/ .48
Stalite	lbs.	.46	/ .48
White	lbs.	1.40	/ 1.50
Aminox	lbs.	.46	/ .55
Betamax Special	lbs.	.68	/ .77
B-L-E	lbs.	.46	/ .55
Flectol H	lbs.	.46	/ .53
Flexamine	lbs.	.61	/ .70
Perfectol	lbs.	.61	/ .68
Rio Resin	lbs.	.50	/ .52
Santoflex 35	lbs.	.61	/ .68
B	lbs.	.46	/ .53
Santovar O	lbs.	1.10	/ 1.17
Santowhite Crystals	lbs.	1.73	/ 1.80
MK	lbs.	1.40	/ 1.52
MKS	lbs.	1.25	/ 1.37
V-G-B	lbs.	.55	/ .64

## Carbon Blacks

### Medium Thermal — MT

Thermax, Stainless

1947, First Five Months

Mapico

1947, First Five Months

Black

Mapico

1947, First Five Months

Red

Mapico

1947, First Five Months

White

Antimony oxide

1947, First Five Months

Rayox LW

1947, First Five Months

R-110

1947, First Five Months

Yellow

Mapico

1947, First Five Months

Latex Compounding Ingredients

Santomerse S

1947, First Five Months

Mold Lubricants

DC Mold Release Fluid

1947, First Five Months

Plasticizers and Softeners

Reogen

1947, First Five Months

Reclaiming Oils

BWH-1

1947, First Five Months

Retarders

E-S-E-N

1947, First Five Months

Vulcanizing Agents

Sulfur, Rubbersmakers 100/lbs.

1947, First Five Months

# CLASSIFIED ADVERTISEMENTS

ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE

Effective July 1, 1947

## GENERAL RATES

Light face type \$1.25 per line (ten words)  
Bold face type \$1.60 per line (eight words)  
Allow nine words for keyed address.

## SITUATIONS WANTED RATES

Light face type 40c per line (ten words)  
Bold face type 55c per line (eight words)

**Address All Replies to New York Office at  
386 Fourth Avenue, New York 16, N. Y.**

## SITUATIONS OPEN RATES

Light face type \$1.00 per line (ten words)  
Bold face type \$1.40 per line (eight words)

**Replies forwarded without charge**

## SITUATIONS WANTED

**CHEMIST AND PRODUCTION ENGINEER. OVER TWENTY** years in applied plastics, resins, rubber, latex, adhesive and chemical fields. Fabric coating and molding. Extensive plant design, management and engineering in diversified lines of chemical technology. B.S. in Chemistry, registered patents. Age 49. Available short notice. Address Box No. 168, care of INDIA RUBBER WORLD.

**TECHNICAL EXECUTIVE WITH 30 YEARS' EXPERIENCE** in rubber and plastics desires position with medium-size or small company in capacity of Factory Manager, Laboratory Director, Technical Superintendent, Sales or Technical Service. Fully qualified in compounding, research, development, and manufacturing. Familiar with factory processing and machinery and latest testing equipment and testing techniques. Wide acquaintance in the industry. Address Box No. 169, care of INDIA RUBBER WORLD.

**LATEX FORMER WANTS POSITION. EXPERIENCE: WORKS** and laboratory, latex, colloids, dispersions, compounding, costing. West preferred. Address Box No. 170, care of INDIA RUBBER WORLD.

**CHEMIST—23 YEARS' BROAD EXPERIENCE: COMPOUNDING,** processing, director of laboratories, tires, mechanicals. Wants technical or management work. Address Box No. 179, care of INDIA RUBBER WORLD.

**YOUNG CHEMICAL ENGINEER WITH MANAGEMENT EXPERIENCE** in development and production of synthetic rubbers, molded and extruded goods, plastic films and flooring, coated fabrics, rubber chemicals, etc., desires responsible position with good future outlook in development, production, or sales engineering of plastics, rubber, chemicals, or equipment. Availability two weeks. Address Box No. 183, care of INDIA RUBBER WORLD.

**RUBBER CHEMIST—CHEMICAL ENGINEER 14 YEARS' EXPERIENCE.** Production or technical sales. Compounder, production supervision and development. Tires, tubes, retreading materials, matting, and floor tile. Thirty-five; married. Interested in future. Address Box No. 184, care of INDIA RUBBER WORLD.

**THIS INDUSTRIAL SALESMAN WANTS TO SELL—OR MANAGE** a sales branch—for a manufacturer of industrial products. He has sold top-priced semi-technical products to industry for six years, covering the Borough of Manhattan in N.Y.C. In conjunction with sales, he has had a year of customer contact Market Research field work, developing new industrial product uses for pressure-sensitives and modifying them. He knows shop practices, men and how to get a product specified. Prior to selling industrial products, he sold advertising for seven years in N.Y.C. and Chicago; was Branch Sales Manager at Paterson, Schenectady and Buffalo for two years, running a 20-man sales force. 46, single, healthy, well educated. Ex-USN, WW II; served for three years, mainly at a NOB in Africa, honorably discharged. Will travel based on N.Y.C., cover N.Y.C., or both. Available August 30. Desired compensation, \$4,420. Address Box No. 187, care of INDIA RUBBER WORLD.

**EXECUTIVE — RESEARCH — CHEMIST: 20 YEARS' EXPERIENCE** in developing work and processing of mechanical rubber goods, synthetics, plastics and reclaim manufacturing. Excellent chemical background. Address Box No. 185, care of INDIA RUBBER WORLD.

## The JAMES F. MUMPER Company

### PLANT ENGINEERS

We help you REDUCE COSTS through line production, special machinery, improved methods. Layouts, buildings, and services engineered for maximum efficiency. Your inquiry will receive prompt, courteous attention.

313-14-15 Everett Bldg. Akron 8, Ohio  
Phone — Jefferson 5939

## SITUATIONS OPEN

**SALESMEN FOR SUNDRIES.** EXCELLENT LINE OF BABY pants and plastic novelties. Chain Store and Jobber connections. Write, giving full details of experience. Address Box No. 171, care of INDIA RUBBER WORLD.

**WANTED: CHEMIST FOR SMALL PROGRESSIVE RUBBER COMPANY** in the East. Advise qualifications, etc. Address Box No. 172, care of INDIA RUBBER WORLD.

**RUBBER TECHNOLOGIST—1947 OR 1948 GRADUATE.** LABORATORY development and quality control. Give full details of education, experience, references, salary expected, and recent full-length photograph in first letter. Address Box No. 178, care of INDIA RUBBER WORLD.

**WANTED: PH.D. FOR RESEARCH IN THE FIELD OF PLASTICS.** Some industrial experience preferred. Southwestern location. Write R. R. Couch, Research and Development Department, Phillips Petroleum Co., Bartlesville, Oklahoma.

**WANTED: RUBBER CHEMIST OR CHEMICAL ENGINEER** with experience in sponge or foam rubber production; desired for pilot-plant operation and application engineering in production plants. Address Box No. 189, care of INDIA RUBBER WORLD.

**COMPANY SUPPLYING RUBBER COMPOUNDING MATERIALS** and machinery wants young man for export sales promotion, including foreign travel. Compounding and/or technical sales background essential, foreign languages desirable. Address Box No. 182, care of INDIA RUBBER WORLD.

## BUSINESS OPPORTUNITIES

**COMPOUNDING, MILLING, SHEETING, PRESSING, GRINDING** with your materials on contract basis. Wide experience, vinyls, polyethylene, polystyrene, all plastics and synthetics. Modern plant. **JERSEY PLASTIC CORPORATION, 42-61 24th Street, Long Island City 1, N. Y. Ironsides 6-6680.**

**FOR SALE: RUBBER FACTORY IN METROPOLITAN AREA** manufacturing molded rubber items. Good backlog of orders. 25% return on investment, \$120,000 required. Owner has other interests. Address Box No. 186, care of INDIA RUBBER WORLD.

**WANTED — Large engineering firm wishes to acquire** several complete Rubber plants through purchase of (1) capital stock, (2) assets, (3) machinery and equipment, whole or in part. Personnel retained where possible, strictest confidence. Box 1220, 1474 Broadway, New York 18, N. Y.



## INDUSTRIAL RUBBER GOODS

BLOWN — SOLID — SPONGE  
FROM NATURAL, RECLAIMED, AND SYNTHETIC RUBBER  
**THE BARR RUBBER PRODUCTS CO. SANDUSKY OHIO**

# FLEXO JOINTS

FOR ALL MOVING FEED LINES

### ECONOMICAL



Low maintenance cost



Rugged, simple construction

### SAFE

STYLE "F"



Long trouble-free service

### DEPENDABLE



NO SPRINGS, NO GROUND SURFACES TO WEAR, NO SMALL OR COMPLICATED PARTS.

**FLEXO SUPPLY CO., 4651 Page Blvd., St. Louis 13, Mo.**

In Canada 1115 Dupont St., Toronto 5, Ontario

(Classified Advertisements Continued on Page 737)

## Rims Approved and Branded by The Tire & Rim Association, Inc.

### RIM SIZE

			RIM SIZE			
15" & 16" D.C. Passenger	May, 1948	June, 1948	Tractor & Implement	May, 1948	June, 1948	
15x3.50D	2,356	12x2.50C...	37,624	24,527		
16x4.00E	229,604	180,971	12x3.00D	21,940	22,670	
15x4.50E	7,344	1,919	15x3.00D	28,460	2,226	
16x4.50E	126,613	233,417	18x3.00D	3,028		
15x5.00E	116,142	116,671	19x3.00D	22,678	19,913	
16x5.00F	20,759	48,827	21x3.00D		700	
15x5.50F	63,762	26,464	36x3.00D	1,071		
16x5.50F	9,807	5,361	16x4.25KA		2,007	
16x6.00F	6,462		16x4.75KA	1,095		
16x4.00E Hump	16,572	7,314	20x4.50E	2,106		
16x4.25E Hump	490		22x4.50E		449	
16x4.50E Hump	13,588	10,165	36x4.50E		1,021	
15x4.12-K	81,956	26,750	18x5.50F		23,742	
16x4.12-K	58,797	59,230	20x5.50F		11,106	
15x5.5-K	284,295	477,348	24x5.50R	2,016	4,826	
16x5.5-K	153,539	130,884	24x6.00S	2,111	681	
15x5.5-K	136,874	115,748	36x6.00S	1,429		
15x6-L	93,431	116,061	24x8.00T	4,851	3,237	
16x6-L	26,367	4,560	28x8.00T	308		
15x6.12-L	100,623	144,511	32x8.00T		326	
15x4.12-K Hump	73,931	193,728	36x8.00T	1,754		
15x5.5-K Hump	56,664	99,661	40x8.00T	112		
15x5.5-K Hump	36,621	70,439	44x8.00T	150		
15x6-L Hump	7,735	9,924	W6-24	3,109	2,746	
15x6.12-L Hump	1,166		W7-24	2,913	8,726	
			W8-24	8,726	10,782	
			W9-24	11,002	18,639	
			W8-24 (H)		1,953	
17" & Over						
18x2.15B		1,539	W8-28	309		
18x3.62F	2,153		W8-32	1,494		
19x2.15B	3,792	4,085	W8-34		1,522	
18x4.00F		2,854	W8-36		3,804	
Flat Base Truck			W9-28	24,296	26,399	
20x4.33R	2,335		W9-36		457	
10x4.50R	7,365		W9-38		6,940	
17x5.0	15,931	22,193	W10-28		2,196	
18x5.0	10,953	27,249	W10-36		1,526	
20x5.0	15,436	59,156	W10-38		738	
17x5.00R	2,630	6,386	DW9-38		3,169	
20x5.00R	4,597	5,726	DW11-36		1,833	
18x5.00S	785		DW11-38		14,175	
20x5.00S	18,978		DW12-26		1,081	
15x5.5	2,154		DW12-30		12,936	
17x5.5	4,657	35,472	DW12-34		2,081	
20x5.5	42		DW14-28		485	
20x6.0	225,368		DW14-30		2,061	
20x5.50S	6,764		DW14-34		169	
24x5.50S	1,242		DW14-38		336	
15x6.0	1,323		DW16-26		596	
17x6.0	360					
20x6.0		143,552	Earth Mover			
20x6.00S	108,377	93,647	20x11.25	206		
20x6.00T	7,914	1,092	24x11.25	326	5	
15x6.5		518	20x13.00		4	
20x6.5	2,279	17,170	24x13.00	82	47	
15x6.50T	424		29x13.00		38	
20x6.50T	30,704	16,817	32x13.00		62	
24x6.50T		589	24x15.00	425		
20x7.0	23,083	12,811	25x15.00	367		
20x7.00T	5,127	5,325	29x15.00	3	266	
20x7.33V	10,237	14,553	25x17.00	41	81	
22x7.33V		4,128	29x17.00	1	192	
20x7.5	2,679	10,881	29x19.50	5	48	
22x7.5		2,078	33x19.50	2		
20x7.50V	10,310	15,670	33x22.00	9		
22x7.50V	3,613					
20x8.0		1,272	TOTALS	2,563,828	2,907,574	
22x8.0		1,050				
24x8.0		1,549				
20x8.00V		4,228				
22x8.00V		8,820				
19x8.37V		2,744				
20x8.37V		1,609				
20x8.37V		857				
20x8.37V		1,013				
24x8.37V		824				
19x9.00V		227				
24x9.00V		100				
20x10.00		79				
20x10.00W		111				
20x10.00W		852				
24x10.00W		1,466				

### Semi D. C. Truck

16x4.50E	4,098	22,628
15x5.50F	3,455	
15x5.50F	36,684	28,684
16x5.50F	33,648	3,733
16x6.00G	1,979	
16x6.50H	1,325	

## FINANCIAL

**Collins & Aikman Corp.**, Philadelphia, Pa., and domestic subsidiary. Quarter ended May 29: net profit, \$366,014, equal to 65¢ a common share, against \$243,646, or 43¢ a share, in the 1947 quarter.

### Dividends Declared

#### COMPANY

COMPANY	STOCK	RATE	PAYABLE	STOCK OF RECORD
Crown Cork & Seal Co., Inc.	Com.	\$0.25	Aug. 27	Aug. 6
Firestone Tire & Rubber Co.	Pfd.	1.12 1/2 q.	Sept. 1	Aug. 14
Goodall Rubber Co.	Com.	0.10 extra	Sept. 15	Sept. 1
Goodall Rubber Co.	Com.	0.15	Aug. 16	Aug. 2
Goodyear Tire & Rubber Co.	Com.	1.00 q.	Sept. 15	Aug. 16
Goodyear Tire & Rubber Co.	Pfd.	1.25 q.	Sept. 19	Aug. 16
Hewitt-Robins, Inc.	Com.	0.25 q.	Sept. 15	Aug. 26
Philadelphia Insulated Wire Co.	Com.	0.25 irreg.	Aug. 10	Aug. 5
A. G. Spalding & Bros., Inc.	Com.	0.37 1/2 q.	Sept. 15	Sept. 8
Swan Rubber Co.	4.8% Pfd.	1.20 q.	Aug. 1	July 22
United States Rubber Co.	Com.	1.00	Sept. 10	Aug. 23
United States Rubber Co.	Pfd.	2.00 q.	Sept. 10	Aug. 23

**Brunswick-Balke-Collender Co.**, Chicago, Ill., and subsidiaries. Six months to June 30: net profit, \$50,091, equal to 96¢ a common share, against \$329,598, or 58¢ a share, in the like period of 1947: sales, \$12,055,377, against \$12,082,729.

**Crown Cork & Seal Co., Inc.**, Baltimore, Md., and wholly owned domestic subsidiaries. First half, 1948: net income, \$2,749,796, equal to \$2.05 a common share, against \$1,887,914, or \$1.33 a share, in the like period last year; sales, \$47,434,456, against \$35,190,523.

**The Eagle-Picher Co.**, Cincinnati 1, O., and domestic subsidiaries. Six months to May 31: consolidated net earnings, \$1,870,031, equivalent to \$2.10 each on 889,076 shares of common stock outstanding, against \$2,199,025, or \$2.47 a share, in the six months ended May 31, 1947; net sales, \$35,805,904, against \$39,991,447.

**General Electric Co.**, Schenectady, N. Y., and consolidated affiliates. First half, 1948: net income, \$54,602,339, equal to \$1.89 a common share, against \$42,802,075, or \$1.48 a share, in the 1947 period; net sales, \$772,761,792, a new high, against \$601,342,810; reserve for federal income tax, \$45,000,000, against \$26,609,647.

**The General Tire & Rubber Co.**, Akron, O., and subsidiaries. Six months ended May 31, 1948: net profit, \$1,713,367, equal to \$2.46 a common share, compared with \$2,650,912, or \$4.06 a share, a year earlier; net sales, \$46,782,583, against \$61,716,823.

**Phillips Petroleum Co.**, Bartlesville, Okla., and subsidiaries. June half, 1948: net profit, \$36,481,282, equal to \$6.03 each on 6,045,106 common shares outstanding, contrasted with \$15,459,699, or \$3.14 each on 4,916,987 shares, in the six months to June 30, 1947: provision for contingencies, \$2,000,000, against \$1,275,000; deductions for depletion, depreciation, development costs, and retirements, \$21,105,418, against \$16,382,202; reserve for taxes, \$12,942,400, against \$6,003,000.

**Socony-Vacuum Oil Co., Inc.**, New York, N. Y. First six months, 1948: consolidated net income, \$71,000,000, equal to \$2.28 a share, against \$40,900,000, or \$1.31 a share, in the 1947 half.

**Sun Oil Co.**, Philadelphia, Pa., and subsidiaries. First six months, 1948: consolidated net income, \$22,799,153, equal to \$4.98 each on 4,532,311 common shares, against \$11,300,170, or \$2.71 each on 4,119,224 shares, in the first half last year.

**Union Carbide & Carbon Corp.**, New York, N. Y., and subsidiaries. First half, 1948: consolidated net income, \$47,061,574, equal to \$1.63 a capital share, against \$36,071,419, or \$1.25 a share, in the 1947 period.



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## L. ALBERT & SON COAST-TO-COAST TRENTON, N. J.—MAIN OFFICE

### CLASSIFIED ADVERTISEMENTS

Continued

#### MACHINERY AND SUPPLIES FOR SALE

FOR SALE: 1—WATSON-STILLMAN HYDRO-PNEUMATIC ACCUMULATOR, low and high (3,000<sup>psi</sup>) pressure) with pumps and all accessories; 4—42" x 42", 8-opening, Hydraulic Presses with 24" rams, pumps, and motors; 1—48" x 48", 3-opening, Hydraulic Press with 40" rams; several other various sizes. 1—5' x 24" Vulcanizer with quick-opening door. 1 Royle  $\frac{1}{2}$ " Tuber. Also Mills, Calenders, etc. Send us your inquiries. CONSOLIDATED PRODUCTS CO., INC., 13-16 Park Row, New York 7, N. Y. Telephone: BARclay 7-0600.

FOR SALE—BECAUSE OF PROCESS CHANGE: TWO WESTINGHOUSE INDUSTRIAL-TYPE Radio-Frequency Generators, 20 K.W., 450 Kilocycles, 440 volts, 3-phase, 60 cycles. In good working condition—used only six months. Address Box No. 173 care of INDIA RUBBER WORLD.

FOR SALE: COMPLETE EQUIPMENT FOR A SMALL RUBBER testing laboratory as follows: 1—6" x 12" rubber mill with drive; 1 No. 0 Banbury mixer with drive; 1 curing press with 2 sets of 4-cavity molds for curing 6" x 6" test slabs; molds for abrasion blocks (Du Pont Abrader), resilience blocks 1.5" dia. x 0.5"; 1 air compressor; 1 Scott plastometer; 1 T-50 machine; 1 Scott tester with auxiliary equipment for testing hard rubber; 1 arbor press with dies for cutting samples; 1 Du Pont abrader; Shore Durometers "A" and "D"; 2 aging ovens; miscellaneous gages, etc. Prefer to sell in one lot. All above in perfect condition. Address Box No. 174, care of INDIA RUBBER WORLD.

FOR SALE: LABORATORY RUBBER MILL, 6" x 12", FULLY equipped with scraper blade, solenoid brake, gear motor, and starter. Used about 30 hours. Price: \$2,000, f.o.b. Philadelphia. Prompt shipment. Address Box No. 175, care of INDIA RUBBER WORLD.

FOR SALE: 2—THROPP 30" 2-ROLL MILLS; 7—JACKETED double-arm mixers, 50/150 gal. Also filters, kettles, pumps, grinders. Surplus equipment bought. PERRY EQUIPMENT CORP., 1524 W. Thompson St., Philadelphia 21, Pa.

FOR SALE: BANBURY MIXER BODIES, NO. 9, SPRAY OR jacketed types, completely rebuilt. Interchange for your worn Banburies, save time. Write, wire, or phone Interstate Welding Service, exclusive specialists in Banbury Mixer rebuilding, 914 Miami Street, Akron 11, Ohio.

FOR SALE: BAKER-PERKINS 200-GAL. & 100-GAL. DOUBLE-arm jack Mixers, also 50, 20, 9 & Lab. 0.7 gals.; Royle  $\frac{1}{2}$ " Perfected Extruder; Thropp 16" x 36", 2-Roll Rubber Mill, also Lab. size, 30", 36", 40", 42", 48", 60", 84" sizes; Rubber Calenders 30", 34", & 60"; Rubber Tubers 2" to 6"; Large stock Hydraulic Presses from 12" x 12" to 42" x 48" platens, from 50 to 500 tons; Hydraulic Pumps & Accumulators; H.P.M. 4.0oz. Injection Molding Machine, other sizes 1 to 16 oz.; Stokes & Colton single punch & rotary Preform Tablet Machines, 1/2" to 2"; Banbury Mixers; Kettles; Tanks; Rotary Cutters; Grinders & Crushers; Mixers; Pumps; etc.

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(Classified Advertisements Continued on Page 738)

# CLASSIFIED ADVERTISEMENTS

Continued

## MACHINERY & SUPPLIES FOR SALE (Continued)

**FOR SALE—IMMEDIATE DELIVERY—ONE NEW NATIONAL** Erie Corporation 10" Heavy-Duty Strainer, Unit Construction fully enclosed, double reduction herringbone gear drive, end delivery, quick opening head, independent motor-driven cut-off attachment, powered by 150 H.P., 900 R.P.M., 440V, 60-Cycle, 3-Phase squirrel cage induction motor and 150 H.P. magnetic reversing line starter, including forward-reverse-stop push button. Inquiries solicited. Address Box No. 181, care of INDIA RUBBER WORLD.

**TITANON A-L-O.**, APPROXIMATELY ONE TON FOR SALE, BOX 50, Ozone Park, N. Y.

**FOR SALE: 23 BANBURY MIXER** in good repair and presently operating. This machine is complete with 75 H.P., 3-phase, 60-cycle, 440-volt motor and starter equipment, 4" ADAMSON TUBER complete with 10 H.P., 3-phase, 440-volt motor and starter equipment. WESTINGHOUSE 63 K.W., 120 volt D.C. GENERATOR, Type SK, Style 2B3445, Address Box No. 177, care of INDIA RUBBER WORLD.

**FOR SALE — 3 STAINLESS STEEL AMERICAN ANODE LATEX** dipping tanks, new, 42" wide, 19" long, and 18" deep to the false bottom, overall height 26"; No. 1, stainless steel mixing tank; No. 2, stainless steel powder coagulant tank; No. 3, stainless steel plain coagulant tank, Nos. 1 and 2 equipped with 220-volt 3-phase electric motor; No. 3, no motor. Price upon request, f.o.b. Paterson, N. J. HORACE RUBBER PRODUCTS CO., INC., 588 Broadway, New York 12, N. Y.

## MACHINERY & SUPPLIES WANTED

RUBBER MILL 36" TO 40", GOOD CONDITION, WITH MOTOR. Give full particulars, price, location. Address Box No. 176, care of INDIA RUBBER WORLD.

**SMALL PRESS 4"-6" or 8" RAM WITH PLATENS 12" x 12" up to 20" x 20". Steam Heated, 8" Opening. Suitable for 2,000 pounds Line Pressure.** ASSOCIATED RUBBER, INC., Quakertown, Pa.

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6 Hubert Street New York 13, N. Y.

## Dominion of Canada Statistics

### Imports of Crude and Manufactured Rubber

	May, 1948		May, 1947	
	Quantity	Value	Quantity	Value
UNMANUFACTURED				
Balata . . . . . lbs.	4,659	\$ 2,187	5,310	\$ 2,855
Crude Rubber . . . . . lbs.	4,902,530	851,837	10,974,953	2,238,527
Latex . . . . . lbs.	158,576	44,462	80,365	26,642
Rubber, powdered and waste . . . . . lbs.	301,500	16,484	1,986,500	40,669
Recovered . . . . . lbs.	1,970,300	156,126	2,201,100	175,609
Synthetic and substitute . . . . . lbs.	192,300	58,831	399,400	95,279
TOTALS . . . . .	7,529,865	\$ 81,129,927	15,647,628	\$ 82,579,581
PARTLY MANUFACTURED				
Comb blanks of hard rubber . . . . .	8	1,627	8	2,393
Hard rubber in rods or tubes . . . . . lbs.	4,916	2,962	1,483	1,540
Rubber thread, not covered . . . . . lbs.	11,074	15,683	4,617	4,287
TOTALS . . . . .	15,990	\$ 20,272	6,100	\$ 8,220
MANUFACTURED				
Bathing Shoes . . . . .	932	\$ 539	3,264	\$ 1,520
Belting . . . . .		66,057		54,679
Boots and shoes of rubber, n.o.p. . . . . prs.	5,440	2,863	11,198	14,584
Canvas shoes with rubber soles . . . . . prs.	74	202	668	1,313
Cement . . . . .		51,439		59,025
Clothing of waterproofed cotton or rubber . . . . .		5,737		6,897
Druggists' sundries . . . . .		51,861		69,306
Gaskets and washers . . . . .		43,388		23,556
Gloves . . . . . doz. prs.	1,389	4,962	1,524	6,577
Golf balls . . . . . doz.	3,113	12,625	1,699	8,389
Heels . . . . . prs.	13,518	3,013	9,845	834
Hose . . . . .		40,128		48,297
Hot water bottles . . . . .		2,585		5,208
Inner tubes, n.o.p. . . . . no.	824	3,509	8,791	15,345
Bicycle . . . . . no.	17,880	7,480	1,383	942
Liquid sealing compound . . . . .		12,882		11,257
Mats and matting . . . . .		22,142		33,022
Nursing nipples . . . . . gross	1,596	5,433	1,566	4,238
Packing . . . . .		21,463		21,525
Raincoats . . . . . no.	341	3,915	148	595
Tires pneumatic, n.o.p. . . . .	2,338	89,234	12,565	213,328
Bicycle . . . . . no.	6,629	7,335	2,317	3,258
Sold for automobile and motor trucks . . . . . no.	74	1,459	10	365
Other . . . . .		7,718		6,834
Tire repair material . . . . .		4,514		20,522
Other rubber manufactures . . . . .		411,405		305,296
TOTALS . . . . .		\$ 883,868		\$ 936,712
TOTAL RUBBER IMPORTS . . . . .		\$ 82,034,067		\$ 83,524,513

### Exports of Crude and Manufactured Rubber

UNMANUFACTURED				
Crude rubber . . . . . lbs.	2,674,440	\$ 438,186	6,097,378	\$ 1,128,057
Waste rubber . . . . . lbs.	1,380,200	12,088	1,921,200	25,361
TOTALS . . . . .	4,054,640	\$ 450,254	8,018,578	\$ 1,153,418
PARTLY MANUFACTURED				
Soling slabs of rubber . . . . . lbs.			2,622	\$ 749
MANUFACTURED				
Beltng, n.o.p. . . . . lbs.	373,543	\$ 250,420	342,530	\$ 227,063
Belts, fan . . . . .		1,779		9,135
Boots and shoes of rubber, n.o.p. . . . . prs.	90,332	164,965	459,639	711,331
Canvas shoes with rubber soles . . . . . prs.	55,760	54,225	452,673	408,167
Clothing of rubber and waterproofed clothing . . . . .		35,185		59,305
Heels . . . . .	32,536	2,399	133,108	10,040
Hose . . . . .		85,458		88,636
Inner tubes for motor vehicles . . . . . no.	46,956	133,069	81,879	179,941
Soles . . . . . prs.	6,008	2,197	20,376	6,348
Tires, pneumatic for motor vehicles . . . . . no.	73,875	1,960,625	52,769	1,009,108
Other . . . . . no.	689	2,611	15,691	13,698
Wire and cable, copper, insulated . . . . .		210,184		193,921
Other rubber manufactures . . . . .		28,756		113,441
TOTALS . . . . .		\$ 82,931,873		\$ 83,030,134
TOTAL RUBBER EXPORTS . . . . .		\$ 83,382,127		\$ 84,184,391

"Rubber Developments." Vol. 1, No. 4, June, 1948. 40 pages. Issued by British Rubber Development Board, Market Bldgs., Mark Lane, London E.C.3, England. Available from Rubber Development Bureau, 1631 K St., N.W., Washington 6, D. C. This issue contains articles on "Rubber Suspension Systems for Vehicles," 2. The 'Torsilastic' System," by A. S. Krotz; "Rubber and the Chemical Engineer," by H. C. Young; and "Latex Processes and Potentialities." 4. Latex and Fibers," by W. H. Stevens. Also included are stories on the use of rubber powder in road surfaces, infrared drying of sheet rubber, and other topics.

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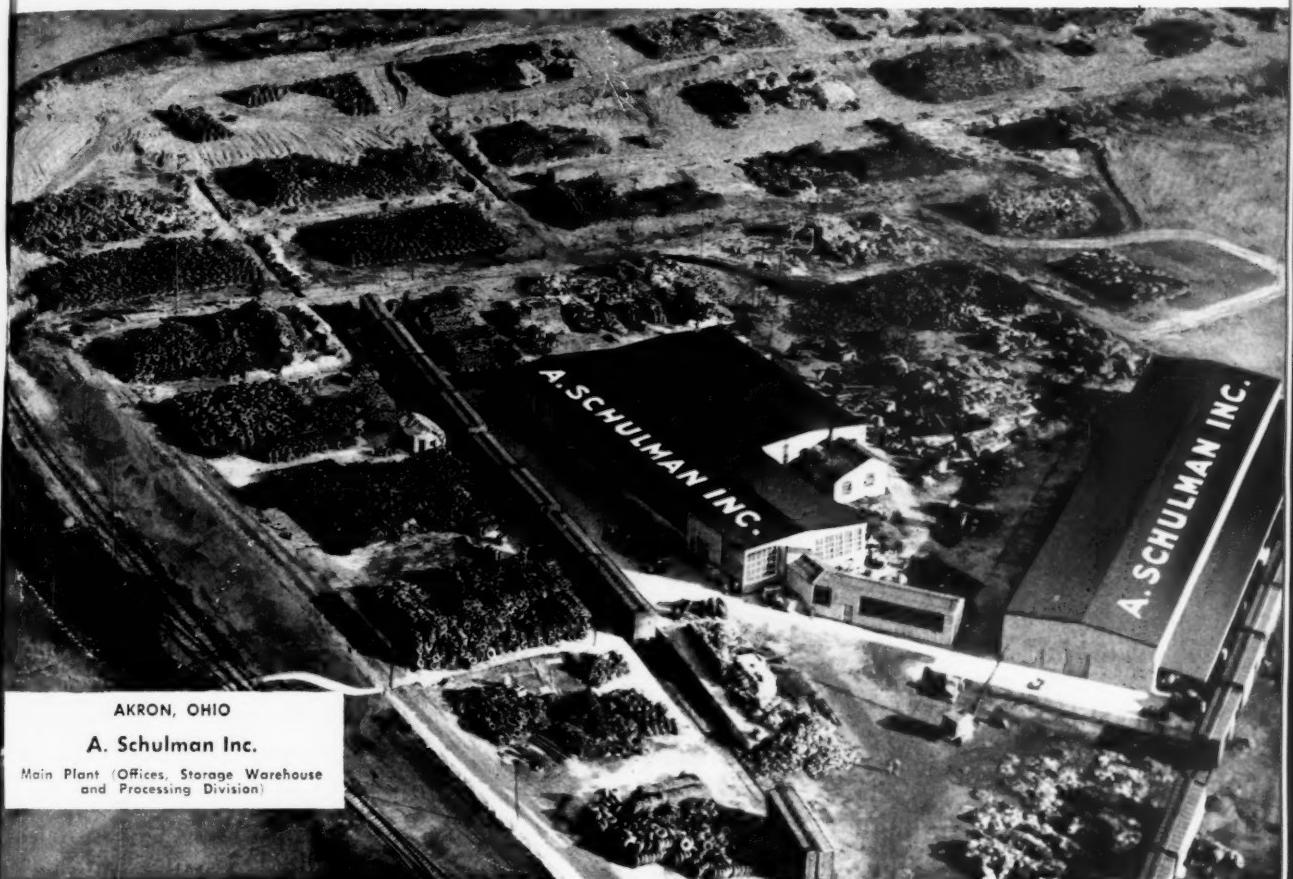
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